Ninth Annual Cyber-Physical Systems Principal Investigators' Meeting

NATIONAL SCIENCE FOUNDATION

November 15 - 16, 2018
Hilton Alexandria Mark Center
Alexandria, Virginia

cps-vo.org/group/cps-pimtg18

The Ninth Annual

NSF CYBER-PHYSICAL SYSTEMS PRINCIPAL INVESTIGATORS' MEETING

Hilton Alexandria Mark Center
Alexandria, Virginia, USA | November 15 - 16, 2018

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WELCOME MESSAGE

Welcome to the 2018 National Science Foundation-sponsored Cyber-Physical Systems Meeting. Over 400 CPS community members representing Academia, Government, and Industry will converge in Alexandria, Virginia for the ninth annual meeting to discuss and showcase the progress of ongoing CPS research and to network. The annual CPS PI Meetings provide an environment to highlight CPS research achievements, support community building, and connect CPS researchers with industry and our current Government partner agencies including DHS, FHWA, NIH, and USDA/NIFA. The event constitutes a unique forum for understanding the state of CPS research in the U.S. and abroad.

We have an engaging two-day agenda. Keynote presentations will be given on days one and two, respectively by Dr. Alberto Ferrari and Dr. Alejandro Miguel San Martin. Dr. Ferrari is the Senior Director of the Model Based Digital Thread Center of Expertise at United Technologies and will offer industry insights to CPS design challenges. Dr. Ferrari is the Chief Engineer of the Guidance and Control Section at the Jet Propulsion Lab at NASA. Among other topics, he will share his experiences dealing with the challenges of landing scientific payloads on Mars and its applicability to the crosscutting CPS science.

The popularity of last year's program made the decision easy to structure the 2018 meeting accordingly. Several sessions came together largely from direct input from our principal investigators. Continued emphasis is placed on the role of women and underrepresented minorities in the CPS Program, increasing PI involvement in the meetings, and enabling an environment for more networking and discussion.

We are again holding the **Women and Under-Represented Minorities Special Interest Networking Lunch** on day one. This year's lunch will have a keynote presentation from Dr. Tonya Smith-Jackson. Dr. Smith-Jackson is a Program Director for the Division of Information and Intelligent Systems and the program for Cultivating Cultures for Ethical STEM at the National Science Foundation. Dr. Jackson will also be presenting NSF perspective on Broadening Participation in Computing (BPC) as part of the CPS Frontier Panel. BPC is an essential element for all new Frontiers and Medium CPS projects.

Seven **Mini-Workshops** are programmed based on topics selected from the community call for workshops. CPS in Agriculture, Edge Computing for CPS Security, Smart Manufacturing, CPS Publishing Tools and Design Studios, and Transitioning CPS research to practice will be this year's featured workshop topics. The workshops will run concurrently for 2.5 hours on day two.

This year, four sessions of **Lightning Project Talks** are programmed to give PIs of largely 2016 and 2017 year awards the opportunity to provide snapshots of the progress of their on-going research in comparison to last year's, that focused largely on 2015 and earlier year awards.

It is our sincere hope that you enjoy the 2018 meeting and that it will inspire the scientific community to continue to make innovative discoveries and contributions to CPS research.

Sincerely, The NSF CPS Team

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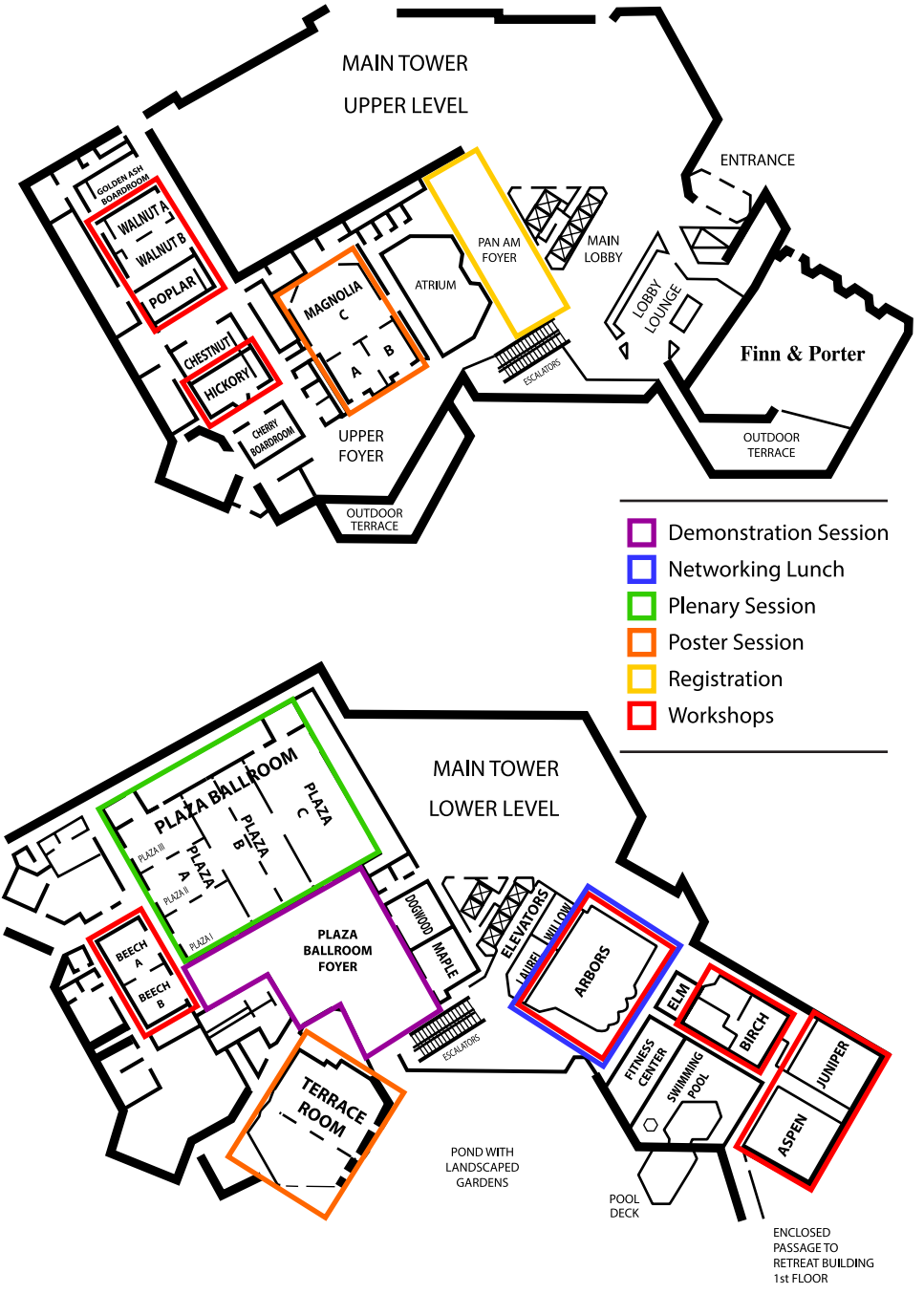
MAIN TOWER
UPPER LEVEL
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WALNUT B
POPLAR
CHESTNUT
HICKORY
CHERRY BOARDROOM
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PROGRAM AGENDA

PROGRAM AGENDA

WEDNESDAY, NOVEMBER 14

TIME	TITLE	LOCATION
6:00pm - 9:00pm	**EARLY REGISTRATION**	PAN AM FOYER *(Upper Level)*

THURSDAY, NOVEMBER 15

TIME	TITLE	LOCATION
7:30am - 5:00pm	**REGISTRATION**	PAN AM FOYER *(Upper Level)*
7:30am - 5:00pm	**HELP DESK**	PAN AM FOYER *(Upper Level)*
7:30am - 8:30am	**CONTINENTAL BREAKFAST**	PLAZA BALLROOM FOYER *(Lower Level)* PAN AM FOYER *(Upper Level)*
8:30am - 9:00am	**NSF WELCOME AND INTRODUCTORY REMARKS** Introduction: Ken Calvert (*CNS Division Director)* CISE AD: Jim Kurose ENG Deputy AD: Linda Blevins	PLAZA BALLROOM *(Lower Level)*
9:00am - 10:00am	**SESSION 1: KEYNOTE** Cyber-Physical System Design Challenges and Opportunities: An Industrial Perspective Alberto Ferrari *(United Technologies)* **Session Lead:** David Corman *(NSF)*	PLAZA BALLROOM *(Lower Level)*
10:00am - 10:15am	**BREAK**	PLAZA BALLROOM FOYER *(Lower Level)* PAN AM FOYER *(Upper Level)*
10:15am - 11:00am	**SESSION 2: PI LIGHTNING TALKS** (90 seconds each) **Session Lead:** Jonathan Sprinkle *(NSF)*	PLAZA BALLROOM *(Lower Level)*
11:00am - 12:00pm	**SESSION 3: CPS START-UPS PANEL** **Session Lead:** Sertac Karaman *(MIT)* **Panelists:** Naira Hovakimyan *(UIUC & IntelinAir)* Darko Marinov *(UIUC & Runtime Verification, Inc.)* Srinivasa Narasimhan *(CMU & RoadRobotics)* Saman Aliari Zounouz *(Rutgers & Sekurity LLC)*	PLAZA BALLROOM *(Lower Level)*

THURSDAY, NOVEMBER 15

TIME	TITLE	LOCATION
12:00pm - 12:15pm	**LUNCH (PICKUP)**	PLAZA BALLROOM FOYER *(Lower Level)*
12:15pm - 1:45pm	**LUNCH (GENERAL)**	PLAZA BALLROOM *(Lower Level)*
12:15pm - 1:45pm	**SESSION 4: WOMEN AND UNDER-REPRESENTED MINORITIES SPECIAL INTEREST NETWORKING LUNCH** *(will run concurrently with general lunch session)* **Keynote:** Tonya Smith-Jackson *(NSF)* **Session Leads:** Sylvia Spengler *(NSF)* Lillian Ratliff *(U Washington)*	ARBORS *(Lower Level)*
1:45pm - 2:25pm	**SESSION 5: PI LIGHTNING TALKS** (90 seconds each) **Session Lead:** Anil Pahwa *(NSF)*	PLAZA BALLROOM *(Lower Level)*
2:25pm - 3:30pm	**SESSION 6: RETROSPECTIVES FOR SELECTED FRONTIERS** **Session Lead:** David Corman *(NSF)* and Tonya Smith-Jackson *(NSF)* **Panelists:** Juan Bello *(NYU)* - SONYC Shankar Sastry *(UC Berkeley)* - FORCES Mani Srivastava *(UCLA)* - ROSELINE	PLAZA BALLROOM *(Lower Level)*
3:30pm - 4:00pm	**BREAK**	PLAZA BALLROOM FOYER *(Lower Level)* PAN AM FOYER *(Upper Level)*
4:00pm - 5:00pm	**SESSION 7: PI LIGHTNING TALKS** (90 seconds each) **Session Lead:** Ralph Wachter *(NSF)*	PLAZA BALLROOM *(Lower Level)*
5:00pm - 7:00pm	**SESSION 8: POSTER SESSION + DEMONSTRATION SESSION (SHOW & TELL)** *Refreshments served*	MAGNOLIA BALLROOM *(Upper Level)* TERRACE BALLROOM *(Lower Level)* PLAZA BALLROOM FOYER *(Lower Level)* PAN AM FOYER *(Upper Level)*
7:00pm	**END OF DAY 1 SESSIONS**	

PROGRAM AGENDA

FRIDAY, NOVEMBER 16

TIME	TITLE	LOCATION
7:30am - 5:00pm	**REGISTRATION**	PAN AM FOYER *(Upper Level)*
7:30am - 5:00pm	**HELP DESK**	
7:30am - 8:30am	**CONTINENTAL BREAKFAST**	PLAZA BALLROOM FOYER *(Lower Level)* PAN AM FOYER *(Upper Level)*
8:30am - 8:45am	**NSF WELCOME AND INTRODUCTORY REMARKS** *Introduction: David Corman (NSF)* *CISE: Rance Cleaveland (DD/CCF)* *ENG: Filbert Bartoli (DD/ECCS)*	PLAZA BALLROOM *(Lower Level)*
8:45am - 10:00am	**SESSION 9: KEYNOTE** Alejandro Miguel San Martin *(JPL/NASA)* The History of Robotic Mars Landings **Session Lead:** Lillian Ratliff *(U Washington)*	PLAZA BALLROOM *(Lower Level)*
10:00am - 10:15am	**BREAK**	PLAZA BALLROOM FOYER *(Lower Level)* PAN AM FOYER *(Upper Level)*
10:15am - 12:45pm	**SESSION 10: MINI WORKSHOPS**	Locations TBA
	Advances and Challenges in Agricultural Cyber-Physical Systems Baskar Ganapathysubramanian *(Iowa State University)* Pavithra Prabhakar *(Kansas State University)* Soumik Sarkar *(Iowa State University)*	
	Digital Twin Technology: A Key Enabler of Smart Manufacturing Kira Barton *(Michigan, Ann-Arbor)* and Sibin Mohan *(UIUC)*	
	Publishing Tools and Design Studios on the CPS-VO Portal Tutorial Janos Sztipanovits *(Vanderbilt University)*	
	Recent Developments on Autonomy and Security of Cyber-Physical Systems Kyriakos G. Vamvoudakis *(Georgia Tech)*	
	Security and Privacy of Cyber-Physical Systems Insup Lee *(University of Pennsylvania)* and Miroslav Pajic *(Duke)*	

FRIDAY, NOVEMBER 16

PROGRAM AGENDA

TIME	TITLE	LOCATION
	Transition to Practice David Corman, Michal Ziv-El, Nizeet Aguilar Saballos, Sylvia Spengler, Ralph Wachter, and Jonathan Sprinkle *(NSF)*	
	Unlocking the Power of Edge Computing for CPS Anish Arora *(The Ohio State University)* Umakishore Ramachandran *(Georgia Tech)*	
12:45pm - 1:00pm	**LUNCH (PICKUP)**	PLAZA BALLROOM FOYER *(Lower Level)* PAN AM FOYER *(Upper Level)*
1:00pm - 2:15pm	**SESSION 11: WORKING LUNCH POSTER SESSION + DEMONSTRATION SESSION (SHOW & TELL)**	PLAZA FOYER *(Lower Level)* MAGNOLIA BALLROOM *(Lower Level)* TERRACE BALLROOM *(Lower Level)*
2:15pm - 3:00pm	**SESSION 12: PI LIGHTNING TALKS** (Frontiers - 3 minutes/Other PI Projects - 90 seconds) **Session Lead:** Nizeet Aguilar *(NSF)*	PLAZA BALLROOM *(Lower Level)*
3:00pm - 3:45pm	**SESSION 13: REPORT BACKS FROM THE WORKSHOPS + WINNER ANNOUNCEMENT** **Session Lead:** Sylvia Spengler *(NSF)*	PLAZA BALLROOM *(Lower Level)*
3:45pm - 4:00pm	**BREAK**	PLAZA BALLROOM FOYER *(Lower Level)* PAN AM FOYER *(Upper Level)*
4:00pm - 4:45pm	**SESSION 14: "ASK A PM/PD ANYTHING"** **Panel Session Lead:** Wendy Nilsen *(NSF)* **Panelists:** David Corman *(NSF)*, Anil Pahwa *(NSF)*, Sylvia Spengler *(NSF)*, Jonathan Sprinkle *(NSF)*, Steven Thomson *(NIFA/USDA)*	PLAZA BALLROOM *(Lower Level)*
4:45pm - 5:00pm	**SESSION 15: CLOSING REMARKS AND NEXT STEPS** **Session Lead:** David Corman *(NSF)*	PLAZA BALLROOM *(Lower Level)*
5:00pm	**CPS PI MEETING ADJOURNED**	

MINI WORKSHOPS & NETWORKING LUNCH

Mini-Workshops and Women and Under-Represented Minorities
Special Interest Networking Lunch
Program Schedules

All Mini-Workshops will run concurrently from 10:15 a.m. – 12:45 p.m. on Friday, November 16th. Locations will be announced at the meeting. Please see the agenda signage outside the meeting room for the location.

current as of 11/8/18

Advances and Challenges in Agricultural Cyber-Physical Systems

Organizers: Baskar Ganapathysubramanian *(Iowa State University),*
Pavithra Prabhakar *(Kansas State),* and Soumik Sarkar *(Iowa State University)*

Agenda

10:15 to 10:20 – Introduction

10:20 to 10:45 – Keynote 1: Dr. Steven J Thomson, USDA NIFA

10:45 to 11:10 – Keynote 2: Prof. Jayne Wu, University of Tennessee - Knoxville

11:10 to 11:35 – Keynote 3: Prof. Asheesh Singh, Iowa State University

11:35 to 12:40 – Panel discussion (Short presentations by panelists 3 mins each followed by discussions)

Panelists –

Marin Kobilarov *(Johns Hopkins University)*
Ajay Sharda *(Kansas State University)*
Jayne Wu *(University of Tennessee - Knoxville)*
Simone Silvestri *(University of Kentucky)*
Girish Chowdhary *(University of Illinois at Urbana Champaign)*

Moderators –

Soumik Sarkar *(Iowa State University)*
Pavithra Prabhakar *(Kansas State University)*

12:40 to 12:45 - Conclusion

Abstract:

Today, efficient and cost-effective sensors as well as high performance computing technologies are transforming traditional plant-based agriculture into sophisticated cyber-physical systems (CPSs). The increased availability of cheap, deployable, connected sensor technology has created an enormous opportunity to collect vast amount of data at varying spatial and temporal scales at both experimental and production agriculture levels. Therefore, both offline and real-time agricultural analytics and control that assimilates such heterogeneous data and provides automated, actionable information and feedback is a critical need for sustainable and profitable agriculture.

In this workshop, we plan to bring together experts from industry, academia and government agencies to identify and discuss critically important challenges in the advancement of agricultural cyber-physical systems. By identifying progress that has been made so far, and challenges for the future, we intend to inspire new ideas and boost research at the intersection of CPS and agriculture.

Digital Twin Technology: A Key Enabler of Smart Manufacturing

Organizers: Kira Barton *(Michigan, Ann-Arbor)* and Sibin Mohan *(UIUC)*

Program Agenda:

The workshop will consist of speakers from academia, industry and government organizations (e.g. NIST). Each presenter will provide their insights into the digital twin technology as well as smart manufacturing in general. This will be followed by an interactive panel discussion.

Attendees are welcome to submit questions, ahead of time, to the organizers via email.

Abstract:

Today's manufacturing paradigm is in the midst of a transformation towards smart manufacturing, driven by the generation and analysis of high-volume data coming from interconnected cyber-physical components. This has necessitated an advancement in a number of the domains related to smart manufacturing such as Industrial Internet of Things (IIoT), Artificial Intelligence (AI), anomaly detection, security of industrial plants, novel communication infrastructures, etc. Among the many Smart Manufacturing tenets, a "digital twin" (DT) represents an opportunity to leverage existing and emerging technologies in modeling, simulation and emulation – to improve quality, productivity and ability to customize and reduce energy consumption and waste.

In this workshop, we intend to bring together researchers and engineers (from academia, industry as well as standards organizations) to provide an overview of the latest advances in DT technology and to create a forum for technical discussion of aspects of DT technology from both theoretical and practical perspectives.

Publishing Tools and Design Studios on the CPS-VO Portal Tutorial

Organizer: Janos Sztipanovits *(Vanderbilt)*

Presenters:

Jnaneshwar Das *(Arizona State)*, **Marcus Lucas** *(UCLA)*,
Rahul Mangharam *(University of Pennsylvania)*, **Patrik Meier** *(Vanderbilt)*,
Stephen Rees *(Vanderbilt)*, and **Janos Sztipanovits** *(Vanderbilt)*

Abstract:

Many successful CPS proposals include commitments to disseminate and make data, models, software, tools, and design studios widely accessible to the research community and potential end-users. However, making research artifacts transitionable is not an easy task. They need to be found, be operational, be made accessible for evaluation (in new application contexts), and offer some basic level of documentation. The CPS-VO Portal incorporates new services and support in the Tools and Design Studios Repository to ensure that research artifacts can be disseminated with minimal effort. There are three basic levels of dissemination methods supported by the CPS-VO Portal: (1) Tool Libraries, (2) Integrated Tools and (3) Design Studios. Tool Libraries are searchable under a community-formed taxonomy and provide visibility and provide visibility for projects via a meta-data driven search. Integrated Tools are directly accessible through the CPS-VO Portal and allow potential users to test capabilities of published tools without a complicated download and installation process using a web interface. Design Studios are self-contained design environments that are embedded in the CPS-VO via an SSL HTML interface. If needed, the pre-configured installations can be hosted within the CPS-VO's cloud infrastructure. Interested users can gain access to tools, run provided examples and tutorials, and generate results without having to download, install, and configure software.

The tutorial will include demonstrations, and provide details and hands-on practice for the use of CPS-VO services for adopting the selected dissemination methods. The tutorial also incorporates discussions on participating in and organizing CPS student competitions.

FRIDAY, NOVEMBER 16

Recent Developments on Autonomy and Security of Cyber-Physical Systems

Organizer: Kyriakos G. Vamvoudakis *(Georgia Tech)*

Speakers:

J. P. Hespanha *(UCSB),* **G. J. Pappas** *(U Penn),* **P. Tabuada** *(UCLA),* **F. Pasqualetti** *(UCR)*

Y. Wan *(UTA),* **R. Gerdes** *(Virginia Tech),* and **K. G. Vamvoudakis** *(Georgia Tech)*

Abstract:

In this workshop we will provide a theoretical modeling, control, and analysis framework for secure, private, safe, and autonomous CPS. The nature of this class of research stems from its ability to generate theoretical and practical advances that will revolutionize the autonomous, secure and safe operation of CPS.

The workshop will start with a talk from J. P. Hespanha on the joint design of estimators and attack policies, to obtain ``resilient'' estimators that use redundancy in an optimal fashion. Then, G. J. Pappas, will deliver a talk about safe autonomy and how ideas, rooted in hybrid systems, can be used to provide a rigorous framework for the analysis of autonomous systems with interacting, model-free and model-based techniques. P. Tabuada in his talk will present several methods for enforcing data privacy using symmetry transformations. The proposed methods will allow the CPS to successfully execute control over the cloud without revealing private information such as state trajectories and plant models. F. Pasqualetti will talk on how network and control theories can be used to tackle security problems in CPS, and how one can develop a set of security tools that are complementary to classic cyber security schemes. R. Gerdes will discuss research gaps in CPS security by examining recent work in the security of automated vehicles, electric vehicles, and aviation systems. Y. Wan will discuss several new directions and recent results that are related to UAS autonomy and airspace safety, including communication and control co-design, networked UAS computing, UAS dynamic games with incomplete information, and airspace safety measures. Finally, K. G. Vamvoudakis will present a learning-based approach to identify the cognitive capabilities of agents having bounded rationality in a CPS operating in uncertain and/or adversarial environments. At the end of the talks, there will be a discussion on the future of autonomy in CPS and metrics for success.

Security and Privacy of Cyber-Physical Systems

Organizers: Insup Lee *(University of Pennsylvania)* and Miroslav Pajic *(Duke)*

Program Agenda:

Panel I (35 minutes): Lessons learned from the Intel-NSF partnership for CPS security & privacy

Short overview and lessons learned from the recently completed large projects on security and privacy of Cyber-Physical Systems, which were funded by the Intel-NSF partnership for security and privacy of CPS.

- **Security and Privacy-Aware Cyber-Physical Systems**
  University of Pennsylvania, Duke University, University of Michigan
  Lead-PI: Insup Lee *(Penn)*
- **CPS-Security: End-to-End Security for the Internet of Things**
  Stanford University, UC Berkeley, University of Michigan
  Lead-PI: Philip Levis *(Stanford)*

Panelists:

- **Richard Chow** *(Intel Research Labs)*
- **Insup Lee** *(University of Pennsylvania)*
- **Miroslav Pajic** *(Duke University)*
- **Kang Shin** *(University of Michigan)*

Panel II (50 minutes): What are the major limitations of the existing security and privacy techniques? What are the problems we should be working on? What is (a) expected, (b) worst-case, and (c) ideal outcome of the security and privacy research done in this domain.

Panelists:

- **Patrick McDaniel** *(Penn State University)*
- **Christina Fragouli** *(UCLA)*
- **Xenofon Koutsoukos** *(Vanderbilt University)*
- **Radha Poovendran** *(University of Washington)*
- **Bruno Sinopoli** *(Carnegie Mellon University)*
- **Saman Zonouz** *(Rutgers University)*

Panel III (50 minutes): What opportunities for CPS security and privacy research are available? How can we make tighter connection between research done within the CPS program, other NSF/DoD agencies and industry? How can we facilitate technology transfer?

Panelists:

- **Sandeep Nima** *(DARPA)*
- **Sukarno Mertoguno** *(ONR)*
- **Richard Chow** *(Intel Research Labs)*
- **David Corman** *(NSF)*
- **Tomas Vagouz** *(NITRD)*

Abstract:

The workshop will address security and privacy challenges in a wide-range of CPS domains with varying level of autonomy and human interaction -- from automotive, aerospace and industrial CPS, to robotics, medical devices and systems, smart-grids and -cities. The focus will be on state-of-the-art techniques in this domain, including their major limitations, as well as security and privacy problems CPS community should be working on. In addition, the workshop will focus on the opportunities for security and privacy research within the NSF CPS program and other NSF/DoD agencies as well as industry, and how can we facilitate technology transfer in this domain.

Transition to Practice

Organizers: David Corman, Michal Ziv-El, Nizeet Aguilar Saballos, Sylvia Spengler, Jonathan Sprinkle, and Ralph Wachter *(NSF)*

Program Agenda:

Introduction to CPS TTP: David Corman *(NSF)*

Panel I: Getting and Running a TTP Award

Moderator: Sylvia Spengler *(NSF)*

Panelists:

- Murat Arcak, *University of California-Berkeley, Award # 1545116*
- Lily-Ageliki Elefteriadou, *University of Florida, Award # 1446813*
- Deniz Erdogmus, *Northeastern University, Award # 1544895*
- Nizar Lajnef, *Michigan State University, Award # 1645783*

Panel II: Federal Perspective on Technology Maturation

Moderator: David Corman *(NSF)*

Panelists:

- Shannon Beck *(NSF Secure and Trustworthy Cyberspace Program)*
- David Kuehn (*Department of Transportation)*
- Christos Papadopoulos *(Department of Homeland Security)*
- Brent Wells (*United States Agency for International Development)*

Abstract:

The CPS program has great interest in foundational research with the potential for maturation in industry or for other customers. Over the past five years, the CPS program has included a Transition to Practice (TTP) option to support this technology maturation.

The objective of this interactive, mini-workshop is to provide insight to the community on TTP activities from a government customer perspective and what constitutes a successful CPS TTP award. Attendees will first hear from a panel of CPS researchers who have received TTP awards, followed by a panel of government agency representatives from the Department of Homeland Security, Department of Transportation, US Agency for International Development, and the National Science Foundation. Participants should leave the workshop with a greater understanding of how to formulate new ideas for TTP relevant to current or future research activities.

Unlocking the Power of Edge Computing for CPS

Organizers: Umakishore Ramachandran *(Georgia Tech)* and Anish Arora *(The Ohio State University)*

Speakers:

Broadly speaking, we will structure the workshop with a panel session, wherein ~6 invited speakers will present for 8-9 minutes each in the first hour, followed by an audience-cum-moderator led discussion session during the second hour.

We plan to organize the presentation session in a "storytelling" format, in which the workshop organizers will walk the audience through the issues surrounding Edge/Fog computing, while the invited presentations will delve into specific topics such describing challenges, opportunities, and experiences with Edge computing with special emphasis on CPS. As part of the discussion session in the second hour, we will invite members of the audience who have shared two-page position papers to have the floor to share their concise remarks. The workshop organizers will ensure that there is sufficient time reserved for open-ended questions and brainstorming.

The intent is to end up with a nice compendium of ideas for addressing the challenges and opportunities surrounding Edge Computing. We will make the presentations and position papers accessible through the CPS-VO website. One possible outcome would be material for a "Dear Colleague" letter from NSF soliciting research proposals in the space of Edge Computing challenges in the CPS domain.

The workshop will allow invited panelists to share their perspectives, community participants to briefly share their position papers, and an open discussion. We will also seek position papers (2 pages maximum including figures and citations) to the workshop, by October 31st that addresses any of the following topical areas (a small subset will be selected for a 3-min presentation each):

- Platforms for Edge computing
- Demonstrations of use cases for Edge computing from the CPS domain
- Challenges for CPS services operating with limited and intermittent connectivity to wide-area Internet
- Middleware challenges for a geo-distributed infrastructure comprising edge and cloud
- Social sensing and Edge Computing
- Security, Privacy, and Trust issues with respect to Edge computing

Abstract:

Technological forces and novel applications are the drivers that move the needle in systems and networking research, both of which have reached an inflection point. On the technology side, there is a proliferation of sensors in the spaces in which humans live that become more intelligent with each new generation. This opens immense possibilities to harness the potential of inherently distributed multimodal networked sensor platforms (aka Internet of Things - IoT platforms) for societal benefits. On the CPS application side, large-scale situation awareness applications (spanning healthcare, transportation, disaster recovery, and the like) are envisioned to utilize these platforms to convert sensed information into actionable knowledge. The sensors produce data 24/7. Sending such streams to the cloud for processing is sub-optimal for several reasons. First, often there may not be any actionable knowledge in the data streams (e.g., no action in front of a camera), wasting limited backhaul bandwidth to the core network. Second, there is usually a tight bound on latency between sensing and actuation to ensure timely response for situation awareness. Lastly, there may be other non-technical reasons, including sensitivity for the collected data leaving the locale. Sensor sources themselves are increasingly becoming mobile (e.g., self-driving cars). This suggests that provisioning application components that process sensor streams cannot be statically determined but may have to occur dynamically.

All the above reasons suggest that processing should take place in a geo-distributed manner near the sensors. Fog/Edge computing envisions extending the utility computing model of the cloud to the edge of the network.

The purpose of this workshop is to bring together academic researchers and industry practitioner together to discuss what is being done at the edge. For example, companies are building edge platforms (e.g., CISCO's IOx, Microsoft's Azure IOT Edge), and researchers are exploring novel ideas for unlocking the potential of edge computing (such as low-cost low-power edge solutions, latency/consistency tradeoffs, data resiliency to ward off correlated power failures, and security and privacy issues) that have special significance for CPS. Further edge computing could also pave the way for addressing the digital divide that exists between well-served and under-served communities in this information age.

FRIDAY, NOVEMBER 16

Women and Under-Represented Minorities Special Interest Networking Lunch

Organizers: Lillian Ratliff *(University of Washington)* and Sylvia Spengler *(NSF)*

Abstract:

Due to its popularity last year, we are again programming a Women and Under-Represented Minorities Special Interest Networking Lunch. The event is designed to bring together CPS community members in order to enhance the participation of women and underrepresented minorities in our community. We will provide discussion points around inclusivity and the future of CPS at the various tables. There will be an opportunity at the end of the lunch for each table to share key aspects of the table's discussion. The intention is to create an opportunity to make and reinforce valuable research contacts while enjoying lunch and good conversation.

Lunch Format:

Tables of 10 attendees will have an opportunity to brainstorm and discuss how to increase the involvement of women and under-represented minorities in CPS. Towards the end of the lunch, one designate from each table will report on the discussion.

Date: Thursday, November 15, 2018
Time: 12:15 p.m. – 1:45 p.m.

SPEAKER BIOGRAPHIES

current as of 11/8/18

KEYNOTE - DAY 1 PLENARY

Alberto Ferrari is Senior Director of the Model Based Digital Thread Center of Expertise (COE), a new organization at United Technologies, Co. (UTC) under CTO Paul Eremenko. The COE is focused on accelerating the development and adoption of model-based technology for product design and verification across all business units.

Prior to this role, Alberto was technical lead for model-based technology, co-founder and director of the innovation company ALES s.r.l. that was acquired by UTC in 2012 and integrated into United Technologies Research Center (UTRC), in 2015. Alberto received his master's degree and Ph.D. in electrical engineering and computer science at the University of Bologna, Italy.

Alberto's passion lies in development and deployment of new methods and tools for the design and verification of cyber-physical systems. In the last 10 years, he technically coordinated and lead several European research projects in this technical area, such as SPEEDS, SPRINT, DANSE and MISSION. He is the author of several technical journal articles and conference papers on design tools and methodologies for embedded systems, safety-critical embedded controllers, and hybrid systems. He has taught courses on network and embedded systems for more than 10 years at the University La Sapienza (Roma) and University of Ancona, Italy, where he also advises masters and Ph.D. students.

KEYNOTE - DAY 2 PLENARY

Alejandro Miguel San Martin graduated from Syracuse University with a bachelor's degree in Electrical Engineering in 1982, and then received a master's degree in Aeronautics and Astronautics from the Massachusetts Institute of Technology in 1985. Upon graduation, he was hired by the Jet Propulsion Laboratory where he has worked for 32 years. Early in his career, he contributed to the Magellan mission to Venus and the Cassini mission to Saturn. He was later the Chief Engineer for the Guidance and Control subsystem for the Mars Pathfinder mission, the Mars Exploration Rovers, and the Mars Science Laboratory where he was also the Deputy Phase Lead for Entry, Descent, and Landing. He is currently the Chief Engineer of the Guidance and Control Section and was named JPL Fellow in 2013.

INVITED REMARKS (NSF)

Filbert Bartoli of Lehigh University is currently serving as Director of the Division of Electrical, Communications and Cyber Systems (ECCS) in the Directorate for Engineering at NSF. The ECCS Division promotes fundamental research in device and component technologies, power, controls, computation, networking, communications, and cyber technologies to support the integration and networking of intelligent systems. Before joining the National Science Foundation in 2016, he was Chandler Weaver Chaired Professor and Chair of the Department of Electrical and Computer Engineering at Lehigh for eleven years. From 2000 to 2005, he was a Program Director in the ECCS Division at the NSF. Prior to that he was at the Naval Research Laboratory, where he was the Head of the Advanced Materials Section in the Optical Sciences Division. He is a Fellow of OSA and IEEE, and recently served as IEEE Photonics Society Vice President for Finance and Administration and Editor-in-Chief for the IEEE Journal of Selected Topics in Quantum Electronics. His research activities have included a broad range of topics, such as infrared detection, inorganic and organic optoelectronics, semiconductor physics, quantum well devices physics, and nonlinear optics. His current research interests include nanophotonics and plasmonics for biosensors, solar cells, and slow light applications. His research publications include over 320 technical papers and 20 patents.

Linda G. Blevins joined NSF as the Deputy Assistant Director of the Engineering Directorate in December 2017. For the last decade, she was a Senior Technical Advisor in the Office of the Deputy Director for Science Programs in the DOE Office of Science, where she provided technical and policy advice on all aspects of science funding program management. She previously served as an NSF program director; as a Senior Member of the Technical Staff at Sandia National Labs; and as a NIST research staff member. Her research expertise is in combustion. She received a Ph.D. from Purdue, an M.S. from Virginia Tech, and a B.S. from Alabama, all in mechanical engineering.

SPEAKER BIOGRAPHIES

Kenneth (Ken) Calvert was appointed Division Director for the CISE Division of Computer and Network Systems (CNS) in May 2016. Ken hails from the University of Kentucky, where he is Professor of Computer Science. He has served as Chair of the Department of Computer Science and as Interim Director of the Center for Visualization and Virtual Environments at Kentucky. Ken is a widely recognized leader in the field of computer networks and systems. In his 25-year academic career, he has made contributions in areas including network topology modeling, active and programmable networking, and future Internet architectures. He has published extensively in the literature, and is widely recognized as a leader in his field. In addition, he has been a long-time contributor to NSF activities through workshops, review panels, and as a member of the most recent CNS Committee of Visitors. Ken received his Ph.D. in computer science from the University of Texas at Austin. He received his M.S. degree in computer science from Stanford University, and his B.S. degree in computer science and engineering from the Massachusetts Institute of Technology. Prior to his appointment at the University of Kentucky, he was a Member of the Technical Staff at Bell Laboratories in Holmdel, NJ, and served on the faculty in the College of Computing at the Georgia Institute of Technology. He also brings experience as past Acting President of Lumenware, LLC, a startup focused on seamless interoperability between computer systems and user interfaces. Ken is a Fellow of the IEEE and an active member of the IEEE Computer and Communications Societies.

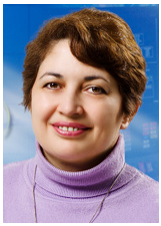
Rance Cleaveland is Professor of Computer Science at the University of Maryland (UMD) at College Park. Since 2018, he has also been serving as Division Director of the Computing and Communication Foundations (CCF) division within the Computer and Information Science and Engineering (CISE) directorate of the National Science Foundation. From 2005 to 2014 he held the position of the Executive and Scientific Director of the Fraunhofer USA Center for Experimental and Software Engineering in College Park. Prior to joining the UMD faculty in 2005, he had professorships at the State University of New York at Stony Brook and at North Carolina State University (NCSU). He is a co-founder, past CEO and current chairman of the board of Reactive Systems, Inc., a company that makes model-based testing tools for embedded software, and a past recipient of National Young Investigator Awards from the National Science Foundation and the Office of Naval Research and the Alcoa Engineering Research prize from North Carolina State University. He has also won undergraduate teaching awards from UMD and NCSU. He has published over 140 papers in the areas of software verification and validation, formal methods, model checking, software specification formalisms, verification tools, software testing, and software architecture. Cleaveland received B.S. degrees (summa cum laude) in Mathematics and Computer Science from Duke University in 1982 and M.S. and Ph.D. degrees from Cornell University in 1985 and 1987, respectively.

Jim Kurose is the Assistant Director of the National Science Foundation (NSF) for Computer and Information Science and Engineering (CISE). He leads the CISE Directorate, with an annual budget of more than $900 million, in its mission to uphold the nation's leadership in scientific discovery and engineering innovation through its support of fundamental research in computer and information science and engineering, state-of-the-art cyberinfrastructure, and education and workforce development. Dr. Kurose is on leave from the University of Massachusetts, Amherst (UMass Amherst), where he has served as Distinguished Professor at the School of Computer Science since 2004. He has also served in a number of administrative roles at UMass and has been a Visiting Scientist at IBM Research; INRIA; Institut EURECOM; the University of Paris; the Laboratory for Information, Network and Communication Sciences; and Technicolor Research Labs. His research interests include network protocols and architecture, network measurement, sensor networks, multimedia communication, and modeling and performance evaluation. Dr. Kurose has served on many national and international advisory boards and panels and has received numerous awards for his research and teaching. With Keith Ross, he is the co-author of the textbook, Computer Networking, a top down approach (6th edition) published by Addison-Wesley/Pearson. Dr. Kurose received his Ph.D. in computer science from Columbia University and a Bachelor of Arts degree in physics from Wesleyan University. He is a Fellow of the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronic Engineers (IEEE).

KEYNOTE - WOMEN AND UNDER-REPRESENTED MINORITIES SPECIAL INTEREST NETWORKING LUNCH

Tonya Smith-Jackson is a program director in the CISE Directorate (IIS Division) and specifically in the Cyber-Human Systems Program. She is also the CISE Cognizant Program Officer for Cultivating Cultures for Ethical STEM (CCE-STEM Program). Tonya worked with a team of CISE program officers to develop the Fairness, Ethics, Accountability, and Transparency (FEAT) Dear Colleague Letter released on 11/5/18, and is a member of the Broadening Participation in Computing (BPC) Working Group at NSF. Before coming to NSF, she was Professor and Chair of Industrial and Systems Engineering at North Carolina Agricultural and Technical State University. Her research areas are cyber-human systems, human-computer interaction, human factors analytics and modeling, and culturally inclusive research and design.

START-UPS PANEL



Naira Hovakimyan received her MS degree in Theoretical Mechanics and Applied Mathematics in 1988 from Yerevan State University in Armenia. She got her Ph.D. in Physics and Mathematics in 1992 from the Institute of Applied Mathematics of Russian Academy of Sciences in Moscow, majoring in optimal control and differential games. Before joining the faculty of UIUC in 2008, she spent time as a research scientist at Stuttgart University in Germany, French Institute for Research in Computer Science and Automation (INRIA) in France, Georgia Institute of Technology, and she was on faculty of Aerospace and Ocean Engineering of Virginia Tech during 2003-2008. She is currently a W. Grafton and Lillian B. Wilkins Professor of Mechanical Science and Engineering at UIUC. In 2015 she was named inaugural director for Intelligent Robotics Lab of Coordinated Science Laboratory at UIUC. She has co-authored two books, six patents and more than 350 refereed publications. She was the recipient of the SICE International scholarship for the best paper of a young investigator in the VII ISDG Symposium (Japan, 1996), the 2011 recipient of AIAA Mechanics and Control of Flight Award, the 2015 recipient of SWE Achievement Award, the 2017 recipient of IEEE CSS Award for Technical Excellence in Aerospace Controls, and the 2019 recipient of AIAA Pendray Aerospace Literature Award. In 2014 she was awarded the Humboldt prize for her lifetime achievements. In 2015, she was awarded the UIUC Engineering Council Award for Excellence in Advising. She is Fellow and life member of AIAA, a Fellow of IEEE, and a member of SIAM, AMS, SWE, ASME and ISDG. She is cofounder and chief scientist of IntelinAir. Her work in robotics for elderly care was featured in the New York Times, on Fox TV and CNBC. Her research interests are in control and optimization, autonomous systems, neural networks, game theory and their applications in aerospace, robotics, mechanical, agricultural, electrical, petroleum, biomedical engineering and elderly care.

SPEAKER BIOGRAPHIES

Sertac Karaman is an Associate Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology (since Fall 2012). He has obtained B.S. degrees in mechanical engineering and in computer engineering from the Istanbul Technical University, Turkey, in 2007; an S.M. degree in mechanical engineering from MIT in 2009; and a Ph.D. degree in electrical engineering and computer science also from MIT in 2012. His research interests lie in the broad areas of robotics and control theory. In particular, he studies the applications of probability theory, stochastic processes, stochastic geometry, formal methods, and optimization for the design and analysis of high-performance cyber-physical systems. The application areas of his research include driverless cars, unmanned aerial vehicles, distributed aerial surveillance systems, air traffic control, certification and verification of control systems software, and many others. He delivered the the Robotics: Science and Systems Early Career Spotlight Talk in 2017. He is the recipient of an IEEE Robotics and Automation Society Early Career Award in 2017, an Office of Naval Research Young Investigator Award in 2017, Army Research Office Young Investigator Award in 2015, National Science Foundation Faculty Career Development (CAREER) Award in 2014, AIAA Wright Brothers Graduate Award in 2012, and an NVIDIA Fellowship in 2011. He serves as the technical area chair for the Transactions on Aerospace Electronic Systems for the robotics area, a co-chair of the IEEE Robotics and Automation Society Technical Committee of Algorithms for the Planning and Control of Robot Motion. He is also Co-founder, President, and Chief Scientist at Optimus Ride, an MIT spinoff company based in Boston, MA that develops self-driving technologies that enable efficient, sustainable, and equitable mobility systems, focused on the fastest path to market.

Darko Marinov is a Professor in the Department of Computer Science at the University of Illinois at Urbana-Champaign. His main research interests are in Software Engineering, especially improving software reliability using software testing. He published over 80 conference papers, winning six ACM SIGSOFT Distinguished Paper awards, one ACM SIGSOFT Impact Paper Award (2012), one ASE Most Influential Paper Award (2015), and one CHI Best Paper Award (2017). He received an NSF CAREER award (2008), an Illinois CAS Beckman Fellowship (2010-2011), an Illinois DCS C.W. Gear Outstanding Junior Faculty Award (2010), and an Illinois Engineering Council Award for Excellence in Advising (2014). He served as the PC Chair for ISSTA (2014) and a PC Co-Chair for ICST (2015), and will serve as a PC Co-Chair for ASE (2019) and ICSE (2020). More info is on his web page: http://mir.cs.illinois.edu/marinov/

SPEAKER BIOGRAPHIES

Srinivasa Narasimhan is a Professor of Robotics and ECE (courtesy) at Carnegie Mellon University. He obtained his PhD from Columbia University in Dec 2003. His group focuses on novel techniques for imaging, illumination and light transport to enable applications in vision, graphics, robotics, agriculture and medical imaging. His works have received several awards: Best Demo Award (IEEE ICCP 2015), A9 Best Demo Award (IEEE CVPR 2015), Marr Prize Honorable Mention Award (2013), FORD URP Award (2013), Best Paper Runner up Prize (ACM I3D 2013), Best Paper Honorable Mention Award (IEEE ICCP 2012), Best Paper Award (IEEE PROCAMS 2009), the Okawa Research Grant (2009), the NSF CAREER Award (2007), Adobe Best Paper Award (IEEE Workshop on Physics based methods in computer vision, ICCV 2007) and IEEE Best Paper Honorable Mention Award (IEEE CVPR 2000). His research has been covered in popular press including NY Times, BBC, PC magazine and IEEE Spectrum and is highlighted by NSF and NAE. He is the co-inventor of programmable headlights, Aqualux 3D display, Assorted-pixels, Motion-aware cameras, Episcan3D, EpiToF3D, and programmable triangulation light curtains. He co-chaired the International Symposium on Volumetric Scattering in Vision and Graphics in 2007, the IEEE Workshop on Projector-Camera Systems (PROCAMS) in 2010, and the IEEE International Conference on Computational Photography (ICCP) in 2011, co-edited a special journal issue on Computational Photography, and serves on the editorial board of the International Journal of Computer Vision and as Area Chair of top computer vision conferences (CVPR, ICCV, ECCV, BMVC, ACCV).

Saman Aliari Zonouz is an Assistant Professor in the Electrical and Computer Engineering Department at Rutgers University since September 2014 and the Director of the 4N6 Cyber Security and Forensics Laboratory. Before, he held a tenure-track position at the University of Miami for three years. His research has been awarded NSF CAREER Award in 2015, Google Security Reward in 2015, Top- 3 Demos at IEEE SmartGridComm 2015, the Faculty Fellowship Award by AFOSR in 2013, the Best Student Paper Award at IEEE SmartGridComm 2013, the University EARLY CAREER Research award in 2012 as well as the Provost Research Award in 2011. The 4N6 research is currently funded by projects from National Science Foundation (NSF), Department of Homeland Security (DHS), Office of Naval Research (ONR), Department of Energy (DOE), Advanced Research Projects Agency Energy (ARPA-E), WinRiver, Google, and Fortinet Corporation including tech-to-market initiatives. Saman's current research focuses on cyber-physical systems security and privacy, industrial control and critical infrastructures, binary/malware analysis and reverse engineering, as well as adaptive intrusion tolerance architectures. Saman has served as the chair, program committee member, guest editor and a reviewer for top international conferences and journals. He obtained his Ph.D. in Computer Science, specifically, intrusion tolerance architectures for the cyber-physical infrastructures, from the University of Illinois at Urbana-Champaign in 2011.

FRONTIERS PANEL

Juan Pablo Bello is Professor of Music Technology and Computer Science & Engineering at New York University. In 1998 he received a BEng in Electronics from the Universidad Simón Bolívar in Caracas, Venezuela, and in 2003 he earned a doctorate in Electronic Engineering at Queen Mary, University of London. Juan's expertise is in digital signal processing, machine listening and music information retrieval, topics that he teaches and in which he has published more than 100 papers and articles in books, journals and conference proceedings. He is the director of the Music and Audio Research Lab (MARL), where he leads research on sound and music informatics. His work has been supported by public and private institutions in Venezuela, the UK, and the US, including Frontier and CAREER awards from the National Science Foundation and a Fulbright scholar grant for multidisciplinary studies in France.

S. Shankar Sastry is currently the Dean of Engineering at University of California, Berkeley and the faculty director of the Blum Center for Developing Economies. From 2004 to 2007 he was the Director of CITRIS (Center for Information Technology in the Interests of Society) an interdisciplinary center spanning UC Berkeley, Davis, Merced and Santa Cruz. He has served as Chairman, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley from January, 2001 through June 2004. From 1999-early 2001, he was on leave from Berkeley as Director of the Information Technology Office at the Defense Advanced Research Projects Agency (DARPA). From 1996-1999, he was the Director of the Electronics Research Laboratory at Berkeley. Dr. Sastry received his Ph.D. degree in 1981 from the University of California, Berkeley. He was on the faculty of MIT as Asst. Professor from 1980-82 and Harvard University as a chaired Gordon McKay professor in 1994. His areas of personal research are resilient network control systems, cybersecurity, autonomous and unmanned systems (especially aerial vehicles), computer vision, nonlinear and adaptive control, control of hybrid and embedded systems, and software. Most recently he has been concerned with critical infrastructure protection, in the context of establishing a ten year NSF Science and Technology Center, TRUST (Team for Research in Ubiquitous Secure Technologies).

Mani Srivastava is on the faculty at UCLA where he is associated with the ECE Department with a joint appointment in the CS Department. His research is broadly in the area of networked human-cyber-physical systems, and spans problems across the entire spectrum of applications, architectures, algorithms, and technologies. His work is inspired by applications in mobile health, smart built environments, and defense, and addresses problems related to making these systems robust, secure, privacy-sensitive, human-aware and learning-enabled He is a Fellow of the ACM and the IEEE. More information about his research is available at his lab's s website at http://www.nesl.ucla.edu and his Google Scholar profile at https://scholar.google.com/citations?user=X2Qs7XYAAAAJ.

MINI-WORKSHOPS ORGANIZERS

Advances and Challenges in Agricultural Cyber-Physical Systems

Baskar Ganapathysubramanian is an associate professor in the department of mechanical engineering. His research interests are in the areas of scientific computing and computational physics. His lab leverages advances in applied mathematics and high-performance computing to model, design and control real-world physical phenomena. From the application point-of-view, his lab is particularly interested in food, energy and environment-related phenomena. His group develops mathematical techniques and computational tools – model reduction, multi-scale frameworks, multi-physics simulators, control algorithms, data-driven methods, high-throughput computing pipelines – to efficiently model these systems. Most of these efforts are done in conjunction with experimental collaborators. Once such application domain has been in cyber-physical agricultural applications. His group focuses on high-throughput algorithms for image processing, data dimensionality reduction, as well as mechanistic models of plant growth. By leveraging machine learning tools with high performance computing, they extract large amount of time series phenotypic data from multiple sensors (field, flight and satellite).

ORGANIZER BIOGRAPHIES

Pavithra Prabhakar is an associate professor in the Department of Computer Science, and Peggy and Gary Edwards Chair in Engineering at the Kansas State University. She obtained her doctorate in Computer Science and a masters in applied mathematics from the University of Illinois at Urbana-Champaign, followed by a CMI postdoctoral fellowship at the California Institute of Technology. Her main research interest is in formal analysis of cyber-physical systems with emphasis on both foundational and practical aspects related to automated and scalable techniques for verification and synthesis of hybrid systems. She is the recipient of a Marie Curie Career Integration Grant from the European Union, a National Science Foundation CAREER Award and an Office of Naval Research Young Investigator Award.

Dr. Soumik Sarkar received his B. Eng. Degree in Mechanical Engineering in 2006 from Jadavpur University, Kolkata, India. He received M.S. in Mechanical Engineering and M.A. in Mathematics in 2009 from Penn State University. Dr. Sarkar received his Ph.D. in Mechanical Engineering from Penn State in 2011. He joined the Department of Mechanical Engineering at Iowa State as an Assistant Professor in Fall 2014. Previously, he was with the Decision Support & Machine Intelligence group at the United Technologies Research Center for 3 years as a Senior Scientist. Dr. Sarkar's research interests include Machine Learning, Sensor Fusion, Fault Diagnostics & Prognostics, Distributed Control and Complexity Analysis with applications to applications to complex Cyber-Physical Systems such as aerospace, energy & smart building systems, transportation, manufacturing and agriculture systems. He co-authored more than 120 peer-reviewed publications including 50 journal papers and 5 book chapters. Dr. Sarkar is currently serving as an Associate Editor of Frontiers in Robotics and AI: Sensor Fusion and Machine Perception journal and an NVIDIA DLI University Ambassadorship. His research was supported by over $8M federal and private funding over the past four years. Dr. Sarkar is a recipient of the prestigious US NSF CISE Career Initiation Initiative (CRII) award in 2015 and the Young Investigator award from the US Air Force Office of Scientific Research (AFOSR) in 2017.

Digital Twin Technology: A Key Enabler of Smart Manufacturing

Kira Barton is an Assistant Professor in the Department of Mechanical Engineering at the University of Michigan. She received her B.Sc. in Mechanical Engineering from the University of Colorado at Boulder in 2001. She continued her education in mechanical engineering at the University of Illinois at Urbana-Champaign and completed her M.Sc. and Ph.D. degrees in 2006 and 2010, respectively. She held a postdoctoral research position at the University of Illinois from Fall 2010 until Fall 2011, at which point she joined the Mechanical Engineering Department at the University of Michigan at Ann Arbor. Kira conducts research in modeling, sensing, and control for applications in advanced manufacturing and robotics, with specializations in Learning Control, advanced manufacturing, and agent-based systems. Kira is the recipient of an NSF CAREER Award in 2014, 2015 SME Outstanding Young Manufacturing Engineer Award, and the 2015 University of Illinois, Department of Mechanical Science and Engineering Outstanding Young Alumni Award.

Sibin Mohan works as a Research Scientist in the Information Trust Institute (ITI) at the University of Illinois at Urbana-Champaign (UIUC), where he does research at the intersection of cyber-physical systems and security. His current work involves the development of secure architectures for embedded control systems, the mitigation of DDoS and malware propagation in smart grids, resilient authentication systems for next-generation aircraft, and the development of system integration concepts ("virtual integration") for complex avionics systems (work that has found acceptance in many avionics companies). In 2008, Sibin completed his Ph.D. in Computer Science at North Carolina State University (NCSU), where he was awarded the "Preparing the Professoriate" fellowship from the graduate school for the 2007-2008 academic year. He completed an M.S. in Computer Science from the same department in 2004. He obtained his Bachelor of Engineering (B.E.) from Bangalore University in Computer Science and Engineering in 2001. Sibin held the positions of Visiting Research Scientist and Postdoctoral Researcher in the Computer Science department at UIUC during 2008-2011. He also worked at Hewlett Packard as a Software Engineer in Bangalore, India from 2001 to 2002. Sibin's research interests include systems (cyber-physical systems, embedded & real-time systems, operating systems), security, computer architecture, and compilers for embedded systems. He serves on multiple conference and workshop program committees.

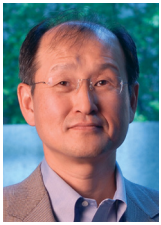
Publishing Tools and Design Studios on the CPS-VO Portal Tutorial

Janos Sztipanovits is currently the E. Bronson Ingram Distinguished Professor of Engineering at Vanderbilt University and he also holds the Joe B. Wyatt Distinguished University Professor title in 2012/2013. He is founding director of the Institute for Software Integrated Systems (ISIS). His research areas are at the intersection of systems and computer science and engineering. His current research interest includes the foundation and applications of Model-Integrated Computing for the design of Cyber-Physical Systems. His other research contributions include structurally adaptive systems, autonomous systems, design space exploration and systems-security co-design technology. He was founding chair of the ACM Special Interest Group on Embedded Software (SIGBED). He served as program manager and acting deputy director of DARPA/ITO between 1999 and 2002 and he was member of the US Air Force Scientific Advisory Board between 2006–2010. He is member of the Academic Executive Board of Cyber-Physical Systems Virtual Organization and he is member of the national steering group. Dr. Sztipanovits was elected Fellow of the IEEE in 2000 and external member of the Hungarian Academy of Sciences in 2010. He won the National Prize in Hungary in 1985 and the Golden Ring of the Republic in 1982. He graduated (Summa Cum Laude) from the Technical University of Budapest in 1970 and received his doctorate from the Hungarian Academy of Sciences in 1980.

Recent Developments on Autonomy and Security of Cyber-Physical Systems

Kyriakos G. Vamvoudakis currently serves as an Assistant Professor at The Daniel Guggenheim School of Aerospace Engineering at Georgia Tech. His research interests include approximate dynamic programming, game theory, and optimal control. Recently, his research has focused on cyber-physical security, networked control, smart grid and multi-agent optimization. Dr. Vamvoudakis is the recipient of a 2018 NSF CAREER award, and of several international awards including the 2016 International Neural Network Society Young Investigator (INNS) Award, the Best Paper Award for Autonomous/Unmanned Vehicles at the 27th Army Science Conference in 2010, the Best Presentation Award at the World Congress of Computational Intelligence in 2010, and the Best Researcher Award from the Automation and Robotics Research Institute in 2011. He is a member of Tau Beta Pi, Eta Kappa Nu and Golden Key honor societies and is listed in Who's Who in the World, Who's Who in Science and Engineering, and Who's Who in America. He has also served on various international program committees and has organized special sessions for several international conferences. He currently is a member of the Technical Committee on Intelligent Control of the IEEE Control Systems Society (TCIC), a member of the Technical Committee on Adaptive Dynamic Programming and Reinforcement Learning of the IEEE Computational Intelligence Society (ADPRLTC), an Associate Editor of Automatica, an Associate Editor of the IEEE Computational Intelligence Magazine, an Associate Editor of the Journal of Optimization Theory and Applications, an Editor in Chief of the Communications in Control Science and Engineering, a registered Electrical/Computer engineer (PE) and a member of the Technical Chamber of Greece. He is a Senior Member of IEEE.

Security and Privacy of Cyber-Physical Systems



Insup Lee is Cecilia Fitler Moore Professor of Computer and Information Science and Director of PRECISE Center, which he co-founded in 2008 at the University of Pennsylvania. His research interests include cyber-physical systems (CPS), real-time systems, embedded systems, high-confidence medical device systems, formal methods, run-time verification, assurance cases, CPS security, and trust management. The theme of his research activities has been to assure and improve the safety, security, and timeliness of life-critical embedded systems. His papers received the best paper awards in IEEE RTSS 2003, CEAS 2011, IEEE RTSS 2012, and ACM/IEEE ICCPS 2014, and the best student paper in IEEE RTAS 2012. Recently, he has been working in medical cyber-physical systems and security of cyber-physical systems. He has served on numerous program committees, chaired many international conferences and workshops and served on various steering and advisory committees of technical societies. He has served on the editorial boards on the several scientific journals, including ACM Transactions on CPS, Journal of ACM, IEEE Transactions on Computers, Formal Methods in System Design, and Real-Time Systems Journal. He is a founding co-Editor-in-Chief of KIISE Journal of Computing Science and Engineering (JCSE). He is Chair of ACM SIGBE (2015-2017) and was Chair of IEEE TCRTS (2003-2004). He was a member of Technical Advisory Group (TAG) of President's Council of Advisors on Science and Technology (PCAST) Networking and Information Technology (2006-2007). He is a member of the National Research Council's committee on 21st Century Cyber-Physical Systems Education (2013-2015). He received an appreciation plaque from Ministry of Science, IT and Future Planning, South Korea, for speaking at the Universal Linkage for Top Research Advisor (ULTRA) Program Forum in 2013. He is IEEE fellow and received IEEE TC-RTS Outstanding Technical Achievement and Leadership Award in 2008.

Miroslav Pajic is the Nortel Networks Assistant Professor in Department of Electrical and Computer Engineering, Duke University, with a secondary appointment in the Computer Science Department. He received the Dipl. Ing. and M.S. degrees from the University of Belgrade, Serbia, in 2003 and 2007, as well as the M.S. and Ph.D. degrees from the University of Pennsylvania, Philadelphia, in 2010 and 2012, respectively. His research interests focus on design and analysis of cyber-physical systems (CPS) and in particular on model-based design of CPS, real-time and embedded systems, high-assurance distributed and networked control systems, and high-confidence medical devices and systems. Dr. Pajic received various awards including the NSF CAREER Award, ONR Young Investigator Program Award, ACM SIGBED Frank Anger Memorial Award, Joseph and Rosaline Wolf Best Dissertation Award from Penn Engineering, IBM Faculty Award, as well as six Best Paper and Runner-up Awards, such as the Best Paper Awards at the 2017 ACM SIGBED International Conference on Embedded Software (EMSOFT) and 2014 ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS), and the Best Student Paper award at the 2012 IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS). He is an associate editor in the ACM Transactions on Computing for Healthcare (ACM HEALTH) and a co-chair of the 2019 ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS'19).

Transition To Practice

Nizeet Aguilar is a 2018-2019 AAAS Science and Technology Policy Fellow working on the Cyber Physical Systems program in the Directorate for Computer and Information Science and Engineering. She received a B.S. in Chemical Engineering from the University of Maryland Baltimore County (UMBC) and a Ph.D. in Biomedical Engineering from Cornell University. Her Ph.D. dissertation involved both tissue engineering and gene therapy to treat focal cartilage lesions with an improved chondrocyte transplantation therapy. She was a National Institute of Health (NIH) postdoctoral fellow at Indiana University–Purdue University Indianapolis (IUPUI) School of Medicine in the Department of Orthopedic Surgery. During her postdoctoral work, she used the pioneering technology, the Regenova 3D Bioprinter (Cyfuse), for three-dimensional cranial bone reconstruction without scaffolds using immortalized mouse bone marrow stromal cells (BMSCs). She was also part of the collaboration between IUPUI and the National Aeronautics and Space Administration (NASA/SpaceX) project aboard the International Space Station (Rodent Research IV) in February 2017. Her research focus was on bone healing and the effects of microgravity on cartilage in space.

ORGANIZER BIOGRAPHIES

David Corman is a Program Director and leader of the Cyber-Physical Systems program at the National Science Foundation. Dr. Corman is a Research Associate Professor at Washington University St. Louis in the Department of Electrical and Systems Engineering. Dr. Corman has a broad range of research interests spanning many technologies fundamental to CPS application areas including transportation, energy, medical devices, and manufacturing. Dr. Corman has extensive industrial experience in the development, design, and manufacture of CPS systems. Dr. Corman received the Ph. D. degree in electrical engineering from the University of Maryland.

Michal Ziv-El is a AAAS Science and Technology Policy Fellow at the National Science Foundation in the Directorate for Computer and Information Science and Engineering, working on the Smart and Connected Communities and Cyber Physical Systems programs. She received a B.S. in Physics and Mathematics from the University of Wisconsin-Madison and a Ph.D. in Environmental Engineering from Arizona State University (ASU). Her research leveraged knowledge of microbial ecology to design biological water treatment and bioremediation approaches, and to investigate the natural and built environments. During her PhD, she was also a founding and active member of the ASU chapter of Engineers Without Borders. She completed a postdoc in microbiology at ASU and one in Environmental Engineering at the University of Texas at Austin

Sylvia Spengler is a program director in the Division of Information and Intelligent System (IIS) within the CISE Directorate at the National Science Foundation. She also served as program officer for the Biological Databases and Informatics in BIO/DBI. Prior to joining NSF, she was a Director of Department of Energy (DOE) Human Genome Program Field Operations. She served as Co-Director of the Program in Mathematics and Molecular Biology at the University of California, Berkeley, Lawrence Berkeley National Laboratory. Her many honors include Senior Fellow of the American Cancer Society, and National Institutes of Health (NIH) Postdoctoral Fellow. As a member of DOE ELSI panels, she has been involved in evaluating the ethical, legal and social implications of human genome research. Dr. Spengler's many publications include co-authorship of the DOE's Primer of Molecular Biology. As part of her work with the Human Genome Project, Dr. Spengler has been involved in many types of public outreach including lectures given to college students, judges, and appearances on public television. Her current NSF programs include: Information and Intelligent Systems-Advancing Human-Centered Computing, Information Integration and Informatics, and Robust Intelligence; CISE Pathways to Revitalized Undergraduate Computing Education (CPATH); Domestic Nuclear Detection Office/National Science Foundation Academic Research Initiative (ARI); Explosives and Related Threats: Frontiers in Prediction and Detection (EXP).

Jonathan Sprinkle is a Program Director in Cyber-Physical Systems at the National Science Foundation in the division of Computer and Networked Systems. His research is in domain-specific modeling for cyber-physical systems with application to autonomous vehicles. He serves as part of the teams for Cyber-Physical Systems, Smart and Connected Communities, Research Experience for Undergraduates, and Formal Methods in the Field. Jonathan joined NSF in 2017 as a rotator from the University of Arizona, where he is the Litton Industries John M. Leonis Distinguished Associate Professor of Electrical and Computer Engineering.

Ralph Wachter is a program director in the Division of Computer and Network Systems at the National Science Foundation.

Unlocking the Power of Edge Computing for CPS

Anish Arora is Professor of Computer Science and Engineering at The Ohio State University, a faculty-in-residence at OSU's Translational Data Analytics Institute, and a co-founder of The Samraksh Company. Arora has engaged in research, development, and translation to practice of device networks and wireless sensor networks since 1999. He is expert in scalability and dependability --in terms of fault-tolerance, stabilization, security, and robustness-- of the application-specific computation and networking in these systems at the wireless edge, and was made an IEEE Fellow in 2008 for contributions to this field. Arora has led the design and development of many fielded wireless networked systems across several application areas. Ongoing related efforts in the Smart and Connected Community context include sound complaint classification (SONYC in New York City), Anti-Poacher Surveillance Networks (HORNNET in South Africa and India), bicycle-pedestrian monitoring sensor networks (PedoCyc at OSU), and Tuscarora software framework (open-sourced by DARPA) for supporting development of heterogeneous, application-specific networks. He is currently a member of OSU's Smart Columbus core team, which is working with the City on smart and connected community projects.

ORGANIZER BIOGRAPHIES

Umakishore Ramachandran received his Ph. D. in Computer Science from the University of Wisconsin, Madison in 1986, and has been on the faculty of Georgia Tech since then. For two years (July 2003 to August 2005) he served as the Chair of the Core Computing Division within the College of Computing. His fields of interest include parallel and distributed systems, computer architecture, and operating systems. He has authored over 100 technical papers and is best known for his work in Distributed Shared Memory (DSM) in the context of the Clouds operating system; and more recently for his work in stream-based distributed programming in the context of the Stampede system. Currently, he is leading a project that deals with large-scale situation awareness using distributed camera networks and multi-modal sensing with applications to surveillance, connected vehicles, and transportation. He led the definition of the curriculum and the implementation for an online MS program in Computer Science (OMSCS) using MOOC technology for the College of Computing, which is currently providing an opportunity for students to pursue a low-cost graduate education in computer science internationally. He has so far graduated 28 Ph.D. students who are well placed in academia and industries. He is currently advising 5 Ph.D. students. He is the recipient of an NSF PYI Award in 1990, the Georgia Tech doctoral thesis advisor award in 1993, the College of Computing Outstanding Senior Research Faculty award in 1996, the College of Computing Dean's Award in 2003 and 2014, the College of Computing William ``Gus'' Baird Teaching Award in 2004, the ``Peter A. Freeman Faculty Award'' from the College of Computing in 2009 and in 2013, the Outstanding Faculty Mentor Award from the College of Computing in 2014, and became an IEEE Fellow in 2014.

"ASK A PM/PD ANYTHING" PANEL

David Corman (Listed on page 40)

Anil Pahwa is a Program Director in Electrical, Communications and Cyber Systems (ECCS) Division at the National Science Foundation and he is University Distinguished Professor in the Department of Electrical and Computer Engineering at Kansas State University. His areas of expertise include power distribution system analysis and design, intelligent computational methods for power systems, optimization methods, and off-grid power systems. He has published over 200 research articles and served as an editor of the IEEE Transactions on Power Systems from 2010 to 2015. Dr. Pahwa received his PhD in Electrical Engineering from Texas A&M University in 1983. He is a fellow of IEEE.

Sylvia Spengler (Listed on page 40)

Jonathan Sprinkle (Listed on page 41)

Ralph Wachter (Listed on page 41)

Steven J. Thomson is a National Program Leader with the USDA National Institute Food and Agriculture (NIFA). He engages Universities, other federal agencies, and industry to provide national leadership in Capacity and Competitive Grant programs. He leads four programs that focus on engineering processes to improve systems relevant to agriculture. These research, education, and outreach activities include precision agriculture, robotics (NSF collaborative), cyber-physical systems (NSF collaborative), and instrumentation and controls. Dr. Thomson co-leads two programs that involve youth farm safety and access to assistive technologies by disabled farmers and veterans. Dr. Thomson has research background in statistics, aerial application of crop protection materials, irrigation management, water balance and crop modeling, decision support systems, agricultural safety, sensor systems and electronics, remote sensing, unmanned aerial systems, and precision agriculture. He has been involved in research, extension, and instruction both as a faculty member at Virginia Tech, where he received the Alpha Epsilon Award for his Research/Extension program, and (more recently) Research Lead Scientist with the USDA ARS.

2018 CPS PI MEETING PROGRAM COMMITTEE

Lillian Ratliff (2018 CPS PI Meeting Chair) is an Assistant Professor in the Department of Electrical Engineering at the University of Washington. Prior to joining UW she was a postdoctoral researcher in EECS at UC Berkeley (2015-2016) where she also obtained her PhD (2015) under the advisement of Shankar Sastry. She holds a MS (UNLV 2010) and BS (UNLV 2008) in Electrical Engineering as well as a BS (UNLV 2008) in Mathematics. Her research interests lie at the intersection of game theory, optimization, and learning. She draws on theory from these areas to develop new theoretical models of human decision-making in societal-scale cyber-physical systems (e.g., intelligent infrastructure) and computational schemes to shape the outcome of competitive interactions. She is a recipient of the NSF graduate research fellowship (2010) and CRII award (2017).

COMMITTEE BIOGRAPHIES

Andrew Clark is an Assistant Professor in the Department of Electrical and Computer Engineering at Worcester Polytechnic Institute. He received his Ph.D. from the Network Security Lab (NSL), Department of Electrical Engineering, at the University of Washington in 2014. He is author or co-author of the IEEE/IFIP William C. Carter award-winning paper (2010), the WiOpt Best Paper (2012), the WiOpt Student Best Paper (2014), and the GameSec Outstanding Paper Award (2018), and was a finalist for the IEEE CDC 2012 Best Student-Paper Award. He received the NSF CRII award in 2017. His research interests are in control and security of cyber-physical systems.

Sam Coogan is an assistant professor at the Georgia Institute of Technology in the School of Electrical and Computer Engineering and the School of Civil and Environmental Engineering. Prior to joining Georgia Tech in 2017, he was an assistant professor in the Electrical Engineering Department at UCLA. He received the B.S. degree in Electrical Engineering from the Georgia Institute of Technology and the M.S. and Ph.D. degrees in Electrical Engineering from the University of California, Berkeley. His research is in the area of dynamical systems and autonomy and focuses on developing scalable tools for verification and control of networked, cyber-physical systems with an emphasis on transportation systems. He received a Young Investigator Award from the Air Force Office of Scientific Research in 2018, a CAREER award from NSF in 2018, the Outstanding Paper Award for the IEEE Transactions on Control of Network Systems in 2017, and the best student paper award for the Hybrid Systems: Computation and Control conference in 2015.

Miroslav Pajic (Listed on page 37)

Pavithra Prabakar (Listed on page 32)

Janos Sztipanovits (Listed on page 34)

Daniel Work is an associate professor in the Department of Civil and Environmental Engineering, the Department of Electrical Engineering and Computer Science, and the Institute for Software Integrated Systems at Vanderbilt University. Prior to joining the faculty at Vanderbilt, Prof. Work was an associate professor in the Department of Civil and Environmental Engineering (tenured), the Department of Electrical and Computer Engineering (courtesy), and the Coordinated Science Laboratory at the University of Illinois at Urbana-Champaign. Prof. Work earned his bachelor of science degree (2006) from the Ohio State University, and a master of science (2007) and Ph.D. (2010) from the University of California, Berkeley, each in civil engineering. Prior to joining the faculty at Illinois as an assistant professor in 2010, Work was a research intern at Nokia Research Center, Palo Alto from 2008-2009, and a guest researcher at Microsoft Research Redmond in 2010. Prof. Work has research interests in transportation cyber physical systems and transportation data analytics. He currently serves as associate editor of IEEE Transactions on Intelligent Transportation Systems and Transportation Research Part C – Emerging Technologies, and is a member of the IEEE Technical Committee on Cybernetics for Cyber-Physical Systems. Prof. Work has received a number of honors and awards including being named to the list of 2018 Pioneers by Connected World, a 2018 Gilbreth Lecturer by the National Academy of Engineering, a UIUC CEE Excellence Faculty Fellow in 2016, the 2015 UIUC ASCE Outstanding Professor, a CAREER Award recipient from the National Science Foundation in 2014, and a recipient of the IEEE ITSS Best Dissertation Award in 2011.

NSF SPONSORS

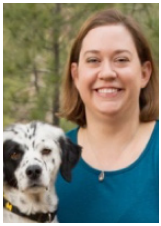
Kishan Baheti is a Program Director for Energy, Power, Control and Networks Program in the Division of Electrical, Communications, and Cyber Systems at the National Science Foundation. Dr. Baheti received the B.S. and M.S. in Electrical Engineering in India from VRCE Nagpur, and from BITS Pilani, respectively. In 1970, he came to USA and received M.S. in Information and Computer Science from University of Oklahoma and Ph.D. in Electrical and Computer Engineering from Oregon State University. In 1976, Dr. Baheti joined the Control Engineering Laboratory of GE Corporate Research and Development Center in Schenectady, NY. His work focused on advanced multivariable control for jet engines, computer- aided control system design, vision-based robots for precision welding, and Kalman filtering. Dr. Baheti and his colleagues received IR-100 award for robotic welding vision system. He has organized a series of educational workshops for GE engineers that resulted in innovative product developments and contributed to enhance university collaborations with GE business divisions. In 1989, Dr. Baheti joined NSF as a Program Director in the Division of Electrical and Communications Systems. His contributions include the development of NSF initiatives on "Combined Research and Curriculum Development", "Semiconductor Manufacturing", and NSF/EPRI Program on "Intelligent Control". In addition, he started NSF Program "Research Experience for Teachers (RET)" to involve middle and high school teachers in engineering research that can be transferred to pre-college classrooms. Recently he is involved in cyber-physical systems, science of learning, and Robotics. He has served as associate editor for IEEE Transactions on Automatic Control, member of the Control Systems Board of Governors, chair for Public Information Committee, and awards chair for the American Automatic Control Council (AACC). He received "Distinguished Member Award" from the IEEE Control Systems Society. In 2013, he received "Outstanding Leadership and Service Award" from the Electrical and Computer Engineering Department Head Association. He was elected a Fellow of IEEE and a Fellow of AAAS.

SPONSOR BIOGRAPHIES

Anindya Banerjee is a Program Director at the National Science Foundation in the CISE Directorate in the Division of Computing and Communication Foundations (CCF) where he focuses on the issues of Software and Hardware Foundations; Exploiting Parallelism for Scalability; Cyber-physical Systems; Research Experience for Undergraduates; CISE Research Initiation Initiatives. Banerjee's research interests span software security, software verification, probabilistic programming, semantics and logics of programs, abstract interpretation, program analysis and program transformation. He received his Ph.D. from Kansas State University, USA, in 1995. After his Ph.D., Anindya was a postdoctoral researcher, first in the Labaratoire d'Informatique (LIX) of Ecole Polytechnique, Paris and subsequently at the University of Aarhus. He joined the IMDEA Software Institute in February 2009 as Full Professor. Immediately prior to this position, Anindya was Full Professor of Computing and Information Sciences at Kansas State University, USA. He was an Academic Visitor in the Advanced Programming Tools group, IBM T. J. Watson Research Center in 2007 and a Visiting Researcher in the Programming Languages and Methodology group at Microsoft Research in 2007–2008. He was a recipient of the Career Award of the US National Science Foundation in 2001.

Sankar Basu a permanent member of NSF scientific staff and is a program Director. He came to NSF from the IBM T. J. Watson Research Center at the beginning of fiscal year 2003. After receiving a Ph.D. from the University of Pittsburgh he served on the faculty of Stevens Institute of Technology, where he taught and conducted funded research (Air Force, NSF), and for a brief period was with the Naval Underwater Systems Center, CT as a visiting senior scientist. He has visited the Ruhr University, Bochum, Germany as an Alexander von Humboldt fellow, and the MIT Laboratory for Information and Decision Systems (LIDS) for extended periods. During the summer of 2012 he was a science advisor to the US Embassy in Berlin, Germany as a State Department Embassy Science Fellow. At NSF his primary responsibilities include Design automation for Micro and Nano-systems, which includes nano-computing architectures, VLSI CAD, Cyber- Physical Systems (CPS) etc. In addition, he participates in interdisciplinary NSF program on the National Nanotechnology Initiative (NNI), and in the past has participated in the Interactions between Mathematics and Computer Science (MCS), Science of Learning Centers (SLC) Program and the Information Technology Research (ITR) program.

SPONSOR BIOGRAPHIES



Dr. Shannon Beck (Steinfadt) is a cybersecurity researcher and educator currently working at the National Science Foundation (NSF) as a Visiting Scientist with the Secure and Trustworthy Cyberspace (SaTC) in the Directorate for Computer & Information Science & Engineering (CISE). Dr. Beck's cybersecurity research focus is on malware classification with the use of bioinformatics tools. Dr. Beck's professional background is diverse, including bioinformatics for biofuel research, training gamification, and operational cybersecurity incident response and research at the Los Alamos National Laboratory in Los Alamos, New Mexico. She is a co-creator of the Entry Point track for the Department of Energy's Cyber Fire Foundry cybersecurity training. Dr. Beck was a participant in the Department of Homeland Security's Transition to Practice (DHS TTP) program, and is now a NSF TTP team member for the multi-directorate SaTC program.

David Corman (Listed on page 38)

Bruce Hamilton is a program director at the U.S. National Science Foundation (NSF). Among various activities at NSF, he is program director for Environmental Sustainability in the CBET Division of NSF's ENG directorate, and a member of the cross-NSF Working Groups for INFEWS (Innovations at the Nexus of Food-Energy-Water Systems), CRISP (Critical Resilient Infrastructure Systems and Processes), and S&CC (Smart & Connected Communities). Additionally, he a program manager for several sustainability Research Coordination Network (RCN) grants. He is also a program director for CyberSEES, Cyber-Physical Systems (CPS), and the Engineering Research Center (ERC) program. In 2012, he received the NSF Director's Award for Meritorious Service in the area of sustainability. Before joining NSF 20 years ago, Bruce held R&D management positions in the chemical and biotechnology industries for 20 years. He has a B.S. in Chemical Engineering and a Ph.D. in Biochemical Engineering, both from MIT.

SPONSOR BIOGRAPHIES

Anthony Kuh started service as a program director for NSF. He is in the Electrical, Communications, and Cyber Systems (ECCS) division working in the Energy, Power, Control, and Network (EPCN) group received his B.S. in Electrical Engineering and Computer Science at the University of California, Berkeley in 1979, an M.S. in Electrical Engineering from Stanford University in 1980, and a Ph.D. in Electrical Engineering from Princeton University in 1987. Dr. Kuh previously worked at AT&T Bell Laboratories and has been on the faculty in Electrical Engineering at the University of Hawai'i since 1986. He is currently a Professor in the Department, serving as director of the interdisciplinary renewable energy and island sustainability (REIS) group, and is also serving as a program director for the National Science Foundation (NSF). Previously, he served as Department Chair of Electrical Engineering Dr. Kuh's research is in the area of neural networks and machine learning, adaptive signal processing, sensor networks, communication networks, and renewable energy and smart grid applications. Dr. Kuh won a National Science Foundation Presidential Young Investigator Award and is an IEEE Fellow. He was also a recipient of the Boeing A. D. Welliver Fellowship and received a Distinguished Fulbright Scholar's Award working at Imperial College in London. Dr. Kuh was an Associate Editor for the IEEE Transactions on Circuits and Systems, served on the IEEE Neural Networks Administrative Committee, served on the IEEE Neural Networks for Signal Processing Committee, and was a Distinguished Lecturer for the IEEE Circuits and Systems Society. Dr. Kuh co-chaired the 1993 International Symposium on Nonlinear Theory and its Applications (NOLTA) and served as the technical co-chair for the 2007 IEEE ICASSP both held in Honolulu. He served as the IEEE Signal Processing Society Regions 1-6 Director at Large and was a senior editor of the IEEE Journal of Selected Topics in Signal Processing. He currently serves on the Board of Governors of the Asia Pacific Signal and Information Processing Association as Vice President of Technical Activities.

Wendy J. Nilsen is a Program Director for the Smart and Connected Health program at the National Science Foundation. Her work focuses on the intersection of technology and health. This includes a wide range of methods for data collection, data analytics and turning data to knowledge. More specifically, her efforts in technlogy and health research include: serving as the lead for the NSF/NIH Smart and Connected Health announcement, convening meetings to address methodology in mobile technology research; serving on numerous federal technology initiatives; and, leading training institutes. Wendy works in multiple trans-NIH initiatives in mobile and wireless health (mHealth). Some of these activities include: coleading the NIH-NSF mPower mHealth group, convening meetings to address methodology and barriers to the utilization of mobile technology in research; serving on numerous federal mHealth initiatives; and, leading the mHealth training institutes.

SPONSOR BIOGRAPHIES

Phil Regalia serves as a Program Director with the National Science Foundation in Arlington, Virgina, within the Directorate for Computer & Information Science & Engineering (CISE). He joined the Department of Electrical Engineering and Computer Science at The Catholic University of America in October 2004 and, from August 2008 through December 2011, served as Chair of that department. Prior to that he was Professor and founding Department Chair of the Communications, Image and Information Processing department of the Institut National des Télécommunications (now "Telecom SudParis"). He obtained his Ph.D. in Electrical Engineering from the University of California at Santa Barbara in 1988, and the Habilitation à Diriger des Recherches from the University of Paris- Orsay in 1994. His research interests include signal processing, information theory, communications, circuits, and matrix/tensor algebra.

Sylvia Spengler (Listed on page 38)

Jonathan Sprinkle (Listed on page 39)

Ralph Wachter (Listed on page 39)

LIGHTNING TALKS

current as of 11/7/18

LIGHTNING TALKS

#	PRESENTER	AWARD TITLE	AWARD #
Round 1: Thursday, November 15, 10:15 AM - 11:00 AM [Session 2]			
1	Behcet Acikmese	CPS: Synergy: Collaborative Research: Semantics of Optimization for Real Time Intelligent Embedded Systems (SORTIES)	1619729
2	Athanasios Antoulas	EAGER: Collaborative Research: Data Science Applications In Cyber-physical Systems for Health	1703170
3	Manimaran Govindarasu	CPS: Medium: Cyber Attack-Defense Modeling, Risk and Contingency Analysis for the Power Grid using Game Theory	1739969
4	Mithat Kisacikoglu	CRII: CPS: Internet-Inspired Autonomous EV Charging	1755996
5	Vijay Gupta	CPS:Small:Collaborative Research: Incentivizing Desirable User Behavior in a Class of CPS	1739295
6	Aaron Becker	CPS: Synergy: Collaborative Research: MRI Powered & Guided Tetherless Effectors for Localized Therapeutic Interventions	1646566
7	Sudip Mazumder	CPS: Breakthrough: Collaborative Research: Transactive control of smart railway grid	1644874
8	Philip Brisk	CPS: TTP Option: Medium: Collaborative Research: Low-Cost, High-Throughput, Cyber-Physical Synthesis of Encrypted DNA	1740052
9	Margaret Martonosi	CPS: Small: Collaborative Research: Towards Secure, Privacy-Preserving, Verifiable Cyberphysical Systems	1739674
10	Luis Jaimes	CPS: Small: RUI: Incentive Mechanisms for Mobile Crowdsourcing, Reaching Spatial and Temporal Coverage Under Budget Constraints	1739409
11	Stephane Lafortune	CPS: Small: Energy-Aware Formal Synthesis for Supervisory Control and Information Acquisition in Cyber-Physical Systems	1738103
12	Patrick Tague	CPS: Breakthrough: Multi-Sensory Event Detection for Cross-Platform Coordination and Verification	1645759
13	Tulga Ersal	CPS: Synergy: Connected Testbeds for Connected Vehicles	1646019
14	Sanjit Seshia	CPS: Breakthrough: Control Improvisation for Cyber-Physical Systems	1646208
15	Qi Zhu	CPS: Synergy: Securing the Timing of Cyber-Physical Systems	1646641
16	Kristin Rozier	CAREER: Theoretical Foundations of the UAS in the NAS Problem (Unmanned Aerial Systems in the National Air Space)	1664356
17	Rose Faghih	CRII: CPS: Wearable-Machine Interface Architectures	1755780
18	Vanessa Frias-Martinez	CAREER: Data-driven Models of Human Mobility and Resilience for Decision Making	1750102
19	Kirstin Petersen	CPS: Medium: Leveraging Honey Bees as Bio-Cyber Physical Systems	1739671
20	Saman Aliari Zonouz	CPS: Medium: Collaborative Research: Trustworthy Cyber-Physical Additive Manufacturing with Untrusted Controllers	1739467
21	Zhenyu Kong	CPS: Medium: Collaborative Research: Cyber-Enabled Online Quality Assurance for Scalable Additive Bio-Manufacturing	1739318
22	Radha Poovendran	Smart and Connected Communities - Visioning Workshop	1624193
23	Yan Wan	CAREER: Co-Design of Networking and Decentralized Control to Enable Aerial Networks in an Uncertain Airspace	1714519

LIGHTNING TALKS

#	PRESENTER	AWARD TITLE	AWARD #
Round 2: Thursday, November 15, 1:45 PM - 2:25 PM [Session 5]			
1	Jin-Oh Hahn	CAREER: Enabling "White-Box" Autonomy in Medical Cyber-Physical Systems	1748762
2	Ye (Sarah) Sun	CAREER: System-on-Cloth: A Cloud Manufacturing Framework for Embroidered Wearable Electronics	1751454
3	Nilanjan Ray Chaudhuri	CPS: Small: Fusion of Sensory Data and Expansivity of System Dynamics for Detection and Separation of Signature Anomaly in Energy CPS Wide-Area Monitoring and Control	1739206
4	Prashant Shenoy	CPS:Breakthrough:Software Defined Solar Systems	1645952
5	Qinru Qiu	CPS: Medium: Enabling Multimodal Sensing, Real-time Onboard Detection and Adaptive Control for Fully Autonomous Unmanned Aerial Systems	1739748
6	Alexandros Labrinidis	CPS: TTP Option: Medium: Building a Smart City Economy and Information Ecosystem to Motivate Pro-Social Transportation Behavior	1739413
7	Christoffer Heckman	CPS: Synergy: Verified Control of Cooperative Autonomous Vehicles	1646556
8	Junmin Wang	CPS: Synergy: Real-Time Cyber-Human-Vehicle Systems for Driving Safety Enhancement	1645657
9	Andre Platzer	CPS: Small: Sound Invariant Generation for Continuous and Hybrid Systems	1739629
10	Paulo Tabuada	CPS: Breakthrough: A science of CPS robustness	1645824
11	Kang Shin	CPS:Small: Imposing Recovery Period for Battery Health Monitoring, Prognosis, and Optimization	1739577
12	Harpreet Dhillon	CPS: Small: Statistical Performance Analysis and Resource Management for Cyber-Physical Internet of Things Systems	1739642
13	Xenofon Koutsoukos	CPS: Small: Integrated Reconfigurable Control and Moving Target Defense for Secure Cyber-Physical Systems	1739328
14	Grace Gao	CAREER: High Integrity Navigation for Autonomous Vehicles	1750864
15	Vanessa Frias-Martinez	Crowdsourcing Urban Bicycle Level of Service Measures	1636915
16	Ross Knepper	CPS: Synergy: Coordinated Action Among Independent Mobile Cyber-Physical Systems	1646417
17	Arslan Munir	CRII: CPS: Design of Secure and Dependable Next Generation Automotive Cyber-Physical Systems	1743490
18	Parasara Duggirala	CPS: Small: Numerical and Symbolic Techniques for Verification and Synthesis of Cyber-Physical Systems	1739936
19	Kornel Ehmann	CPS: Synergy: An Integrated Simulation and Process Control Platform for Distributed Manufacturing Process Chains	1646592
20	Kunal Mankodiya	CAREER: CPS: Internet of Wearable E-Textiles for Telemedicine	1652538
21	Hossein Pishro-Nik	CPS: Medium: A Unified Framework for IoT Privacy	1739462
22	Sule Ozev	CPS: Medium: Collaborative Research: Constantly on the Lookout: Low-cost Sensor Enabled Explosive Detection to Protect High Density Environments	1739451
23	Yaser Fallah	CAREER: Multi-Resolution Model and Context Aware Information Networking for Cooperative Vehicle Efficiency and Safety Systems	1664968

LIGHTNING TALKS

#	PRESENTER	AWARD TITLE	AWARD #
Round 3, Thursday, November 15, 4:00 PM - 5:00 PM [Session 7]			
1	Denise Lach	EAGER: Collaborative Research: Connecting Communities Through Data, Visualizations, and Decisions	1637334
2	Kyriakos G Vamvoudakis	CAREER:Towards an Intermittent Learning Framework for Smart and Efficient Cyber-Physical Autonomy	1750789
3	Geir Dullerud	CPS:SMALL: Privacy-preserving Network Congestion Control: Theory and Applications	1739966
4	Nasim Uddin	CPS: Breakthrough: Mobile Automated Rovers Fly-By (MARS-FLY) for Bridge Network Resiliency	1645863
5	Ella Atkins	CPS: Small: Cyber-Physical Communication for Cooperative Human-Robot Mobility	1739525
6	Prabir Barooah	CPS: Synergy: Distributed coordination of smart devices to mitigate intermittency of renewable generation for a smarter and sustainable power grid	1646229
7	Matthew Travers	CPS: Small: Geometric Self-Propelled Articulated Micro-Scale Devices	1739308
8	John Stankovic	CPS: Breakthrough: Wearables With Feedback Control	1646470
9	Liang Zhang	EAGER: Resilient Control Systems with respect to Instrumentation Attacks: Theory and Testbed Verification	1723341
10	Susmit Jha	CPS: Small: Self-Improving Cyber-Physical Systems	1740079
11	Yunyi Jia	CRII: CPS: Bilateral Adaptation between Models for Human-Perceived Safety/Comfort and Autonomous Driving Controllers	1755771
12	Lu Feng	CRII: CPS: Cognitive Trust in Human-Autonomous Vehicle Interactions	1755784
13	Thomas Kurfess	CPS: Synergy: CNC Process Plan Simulation, Automation and Optimization	1646013
14	Fadel Adib	CPS: Small: Scaling Cyber-Physical Systems to the Low-Power Internet of Things	1739723
15	Emre Salman	CPS: Breakthrough: Charge-Recycling based Computing Paradigm for Wirelessly Powered Internet-of-Things	1646318
16	Christina Fragouli	CPS: Medium: Distorting the adversary's view: a CPS approach to privacy and security	1740047
17	Matthew Peet	CPS: Small: A Convex Framework for Control of Interconnected Systems over Delayed Networks	1739990
18	Ufuk Topcu	CAREER: Provably Correct Shared Control for Human-embedded Autonomous Systems	1652113
19	Miroslav Pajic	CAREER: Foundations for Secure Control of Cyber-Physical Systems	1652544
20	Xiaofeng Wang	CPS: Medium: Collaborative Research: Against Coordinated Cyber and Physical Attacks: Unified Theory and Technologies	1739886
21	Alberto Sangiovanni-Vincentelli	CPS: Medium: Quantitative Contract-Based Synthesis and Verification for CPS Security	1739816
22	Dario Pompili	CPS: Medium: Enabling Real-time Dynamic Control and Adaptation of Networked Robots in Resource-constrained and Uncertain Environments	1739315
23	Cameron (Kamin) Whitehouse	CPS: Medium: Safety-Critical Wireless Mobile Systems	1739333
24	Jules White	Cyber-physical Approaches to Advanced Manufacturing Security	1446304

LIGHTNING TALKS

#	PRESENTER	AWARD TITLE	AWARD #
Round 4: Friday, November 16, 1:00 PM - 2:15 PM [Session 11]			
1	Chee-Wooi Ten	CPS: Medium: Collaborative Research: An Actuarial Framework of Cyber Risk Management for Power Grids	1739422
2	Xuan Zhang	CPS: Medium: Modular Power Orchestration at the Meso-scale	1739643
3	Roger Quinn	CPS: Medium: Integrated control of biological and mechanical power for standing balance and gait stability after paralysis	1739800
4	Junshan Zhang	CPS: Medium: Collaborative Research: Demand Response & Workload Management for Data Centers with Increased Renewable Penetration	1739344
5	Kang Shin	CPS:Breakthrough: Secure Interactions with Internet of Things	1646130
6	Lalitha Sankar	CPS: TTP Option: Synergy: A Verifiable Framework for Cyber-Physical Attacks and Countermeasures in a Resilient Electric Power Grid	1449080
7	Mark Rentschler	CPS: TTP Option: Medium: Synthetic, Distributed Sensing, Soft and Modular Tissue (sTISSUE)	1739452
8	Mani Govindarasu	High-Fidelity, Scalable, Open-Access Cyber Security Testbed for Accelerating Smart Grid Innovations and Deployments	1446831
9	Zak Kassas	CAREER: Situational Awareness Strategies for Autonomous Systems in Dynamic Uncertain Environments	1751205
10	Hamsa Balakrishnan	CPS: Small: Recovery Algorithms for Dynamic Infrastructure Networks	1739505
11	Raghvendra Cowlagi	CPS: Breakthrough: Selective Listening Control for Connected Autonomous Vehicles in Data-Rich Environments	1646367
12	Shreyas Sundaram	CAREER: Towards Secure Large-Scale Networked Systems: Resilient Distributed Algorithms for Coordination in Networks Under Cyber Attacks	1653648
13	Andrew Clark	CRII:CPS:Secure-by-Design Synthesis of Cyber-Physical Systems	1656981
14	Yier Jin	CPS:CNS: Medium: Security Certification of Autonomous Cyber-Physical Systems	181500
15	Calin Belta	CPS: Frontier: Collaborative Research: BioCPS for Engineering Living Cells	1446607
16	Ufuk Topcu	CPS: Frontier: Collaborative Research: Data-Driven Cyberphysical Systems	1646522
17	Cynthia Sturton	CPS: Frontier: Collaborative Research: VeHICaL: Verified Human Interfaces, Control, and Learning for Semi-Autonomous Systems	1545126
18	Scott Smolka	CPS: Frontier: Collaborative Research: Compositional, Approximate, and Quantitative Reasoning for Medical Cyber-Physical Systems	1446832
19	Kira Barton	CPS: TTP Option: Frontiers: Collaborative Research: Software Defined Control for Smart Manufacturing Systems	1544678
20	Payam Heydari	CPS: TTP Option: Frontier: Collaborative Research: A Bi-Directional Brain-Computer Interface for Restoration of Walking and Lower Extremity Sensation after Spinal Cord Injury	1646275

REGISTRANTS

current as of 11/7/18

#	First Name	Last Name	Affiliation	Email
1	Behcet	Acikmese	University Of Washington	behcet@uw.edu
2	Ryan	Adams	UNC Charlotte	radams41@uncc.edu
3	Fadel	Adib	MIT	fadel@mit.edu
4	Chakradhar	Agava	FAA	chakradhar.agava@faa.gov
5	Izath	Aguilar	National Science Foundation	iaguilar@nsf.gov
6	Mahnoosh	Alizadeh	University of California Santa Barbara	alizadeh@ucsb.edu
7	Yiannis	Aloimonos	University of Maryland College Park	yiannis@cs.umd.edu
8	Berk	Altin	University of California, Santa Cruz	berkaltin@ucsc.edu
9	Aaron	Ames	Caltech	ames@caltech.edu
10	James	Anderson	University of North Carolina at Chapel Hill	anderson@cs.unc.edu
11	Tzanis	Anevlavis	University of California, Los Angeles	janis10@ucla.edu
12	Anuradha	Annaswamy	MIT	aanna@mit.edu
13	Chimay	Anumba	University of Florida	anumba@ufl.edu
14	Fatima Muhammad	Anwar	UCLA	fatimanwar@ucla.edu
15	Kenji	Aono	Washington University in St. Louis	kenji@email.wustl.edu
16	Murat	Arcak	UC Berkeley	arcak@berkeley.edu
17	Anish	Arora	The Ohio State University	arora.9@osu.edu
18	Ella	Atkins	University of Michigan	ematkins@umich.edu
19	Roozbeh	Atri	Florida International University	ratri001@fiu.edu
20	Nora	Ayanian	University of Southern California	ayanian@usc.edu
21	Li	Bai	Temple University	lbai@temple.edu
22	Ou	Bai	FIU	obai@fiu.edu
23	Hamsa	Balakrishnan	Massachusetts Institute of Technology	hamsa@mit.edu
24	David	Balenson	SRI	david.balenson@sri.com
25	Filbert	Bartoli	National Science Foundation	filbarto@nsf.gov
26	Kira	Barton	University of Michigan	bartonkl@umich.edu
27	Carolyn	Beck	University of Illinois at Urbana-Champaign	beck3@illinois.edu
28	Juan Pablo	Bello	New York University	jpbello@nyu.edu
29	Calin	Belta	Boston University	cbelta@bu.edu
30	Raheem	Beyah	Georgia Tech	rbeyah@ece.gatech.edu
31	Rahul Kumar	Bhadani	University of Arizona	rahulbhadani@email.arizona.edu
32	Bir	Bhanu	University of California at Riverside	bhanu@cris.ucr.edu
33	Sourabh	Bhattacharya	Iowa State University	sourabh98um@gmail.com
34	Linda	Blevins	National Science Foundation	lblevins@nsf.org

REGISTRANTS

#	First Name	Last Name	Affiliation	Email
35	Gedare	Bloom	Howard University	gedare.bloom@howard.edu
36	Paul	Bogdan	University of Southern California	pbogdan@usc.edu
37	Walker	Boldman	University of Tennessee Knoxville	wboldman@vols.utk.edu
38	Sukumar	Brahma	Clemson University	sbrahma@clemson.edu
39	Arturo	Bretas	University of Florida	arturo@ece.ufl.edu
40	Timothy	Bretl	University of Illinois at Urbana-Champaign	tbretl@illinois.edu
41	Philip	Brisk	University of California, Riverside	philip@cs.ucr.edu
42	Matt	Bunting	University of Arizona	mosfet@email.arizona.edu
43	Samuel	Burden	University of Washington	sburden@uw.edu
44	Kristi	Bushman	University of Pittsburgh	k.bushman@pitt.edu
45	Linda	Bushnell	University of Washington	LB2@uw.edu
46	Brian	Butka	Embry-Riddle Aeronautical University	butkab@erau.edu
47	Alyssa	Byrnes	UNC Chapel Hill	abyrnes1@cs.unc.edu
48	Marco	Caccamo	University of Illinois	mcaccamo@illinois.edu
49	Duncan	Callaway	UC Berkeley	dcal@berkeley.edu
50	Alvaro	Cárdenas	University of Texas at Dallas	alvaro.cardenas@utdallas.edu
51	Christos	Cassandras	Boston University	cgc@bu.edu
52	Ahmet	Cetin	University of Illinois at Chicago	sinancemcetin@gmail.com
53	Shantanu	Chakrabartty	Washington University in St. Louis	shantanu@wustl.edu
54	Aranya	Chakrabortty	North Carolina State University	achakra2@ncsu.edu
55	Animesh	Chakravarthy	University of Texas at Arlington	animesh.chakravarthy@uta.edu
56	Matthew	Chan	Rutgers University	matthew.chan@rutgers.edu
57	Thidapat (Tam)	Chantem	Virginia Tech	tchantem@vt.edu
58	Kaustav	Chatterjee	Penn State University	kuc760@psu.edu
59	Nilanjan Ray	Chaudhuri	Penn State University	nuc88@engr.psu.edu
60	Michelle	Cheatham	Wright State University	michelle.cheatham@wright.edu
61	Stephen	Checkoway	Oberlin College	s@pahtak.org
62	Jiefu	Chen	University of Houston	jchen82@central.uh.edu
63	Lijun	Chen	University of Colorado at Boulder	lijun.chen@colorado.edu
64	Qian	Chen	The Ohio State University	chen.1399@osu.edu
65	Zheng	Chen	University of Houston	zchen43@central.uh.edu
66	Liang	Cheng	Lehigh University	cheng@lehigh.edu
67	Maggie	Cheng	Illinois Institute of Technology	maggie.cheng@iit.edu
68	Elizabeth	Cherry	Rochester Institute of Technology	excsma@rit.edu

#	First Name	Last Name	Affiliation	Email
69	Richard	Chow	Intel	richard.chow@intel.com
70	Girish	Chowdhary	University of Illinois at Urbana Champaign	girishc@illinois.edu
71	Keywhan	Chung	University of Ilinois	kchung10@illinois.edu
72	Andrew	Clark	Worcester Polytechnic Institute	aclark@wpi.edu
73	Christian	Claudel	University of Texas Austin	christian.claudel@utexas.edu
74	Walter Rance	Cleaveland	National Science Foundation	rance@cs.umd.edu
75	Richard	Conroy	National Institutes of Health	conroyri@mail.nih.gov
76	Samuel	Coogan	Georgia Tech	sam.coogan@gatech.edu
77	David	Corman	National Science Foundation	dcorman@nsf.gov
78	Raghvendra	Cowlagi	Worcester Polytechnic Institute	rvcowlagi@wpi.edu
79	Caleb	Crawford	Embry-Riddle Aeronautical University	crawfc16@my.erau.edu
80	Patricia	Culligan	Columbia University	pjc2104@columbia.edu
81	Ashwin	Dani	University of Connecticut	ashwin.dani@uconn.edu
82	Jnaneshwar	Das	Arizona State University	djnan@asu.edu
83	Sajal	Das	Missouri University of Science and Technology	sdas@mst.edu
84	Lou	Deguzman	UNC Charlotte	pcdeguzm@uncc.edu
85	Martin	DePoint	FAA	Martin.DePoint@faa.gov
86	Katie	Dey	Vanderbilt University, ISIS	katie.dey@vanderbilt.edu
87	Francisco	Diez	Rutgers University	diez@jove.rutgers.edu
88	Yu	Ding	Texas A&M University	yuding@tamu.edu
89	Adwait	Dongare	Carnegie Mellon University	adongare@cmu.edu
90	Sandeep	Dsouza	Carnegie Mellon University	sandeepd@andrew.cmu.edu
91	Marco	Duarte	University of Massachusetts Amherst	mduarte@ecs.umass.edu
92	Abhishek	Dubey	Vanderbilt University, ISIS	abhishek.dubey@vanderbilt.edu
93	Parasara Sridhar	Duggirala	University of Connecticut	psd@uconn.edu
94	Geir	Dullerud	University of Illinois	dullerud@illinois.edu
95	Lucy	Dunne	University of Minnesota	ldunne@umn.edu
96	Rohit	Dureja	Iowa State University	dureja@iastate.edu
97	Prabal	Dutta	University of California at Berkeley	prabal@berkeley.edu
98	Raj Gautam	Dutta	University of Florida	r.dutta@ufl.edu
99	Deepak	Edakkattil Gopinath	Northwestern University	deepakedakkattilgopinath2015@u.northwestern.edu
100	Mark	Eisen	University of Pennsylvania	maeisen@seas.upenn.edu
101	Lily	Elefteriadou	University of Florida	elefter@ce.ufl.edu
102	Hamid	Emadi	Iowa State University	emadi@iastate.edu

REGISTRANTS

#	First Name	Last Name	Affiliation	Email
103	Jeremy	Epstein	National Science Foundation	jepstein@nsf.gov
104	Deniz	Erdogmus	Northeastern University	erdogmus@ece.neu.edu
105	Tulga	Ersal	University of Michigan	tersal@umich.edu
106	Sriharsha	Etigowni	Rutgers University	sriharsha.etigowni@rutgers.edu
107	Sina	Faezi	UC Irvine	sfaezi@uci.edu
108	Rose	Faghih	University of Houston	rtfaghih@uh.edu
109	Abdelrahman	Fahim	University of California, Riverside	afahi002@ucr.edu
110	Georgios	Fainekos	Arizona State University	fainekos@asu.edu
111	Yaser	Fallah	University of Central Florida	yaser.fallah@ucf.edu
112	Chuchu	Fan	University of Illinois at Urbana-Champaign	cfan10@illinois.edu
113	Ding-Yu	Fei	Virginia Commonwealth University	fei@vcu.edu
114	Lu	Feng	University of Virginia	lu.feng@virginia.edu
115	Flavio	Fenton	Georgia Tech	flavio.fenton@physics.gatech.edu
116	Cornelia	Fermuller	University of Maryland	fer@cfar.umd.edu
117	Eric	Feron	Georgia Institute of Technology	feron@gatech.edu
118	Cody	Fleming	University of Virginia	cf5eg@virginia.edu
119	Mahsa	Foruhandeh	Virginia Tech	mfhd@vt.edu
120	Christina	Fragouli	UCLA	christina.fragouli@ucla.edu
121	Massimo	Franceschetti	UC San Diego	massimo@ece.ucsd.edu
122	Erik	Fredericks	Oakland University	fredericks@oakland.edu
123	Daniel	Fremont	University of California, Berkeley	dfremont@berkeley.edu
124	Kevin	French	Embry Riddle Aeronautical University	frenchk@my.erau.edu
125	Vanessa	Frias-Martinez	University of Maryland	vfrias@umd.edu
126	Grace	Gao	University of Illinois at Urbana-Champaign	gracegao@illinois.edu
127	Konstantinos	Gatsis	University of Pennsylvania	kgatsis@seas.upenn.edu
128	Dennice	Gayme	Johns Hopkins University	dennice@jhu.edu
129	Jin	Ge	California Institute of Technology	jge@caltech.edu
130	Yufeng	Ge	University of Nebraska-Lincoln	yge2@unl.edu
131	Ravikumar	Gelli	Iowa State University	gelli@iastate.edu
132	Helen	Gill	Private Citizen	hgill.ret@gmail.com
133	Jairo	Giraldo Trujillo	University of Texas at Dallas	jairo.giraldo@utdallas.edu
134	Mani	Golparvar-Fard	University of Illinois at Urbana-Champaign	mgolpar@illinois.edu
135	Manimaran	Govindarasu	Iowa State University	gmani@iastate.edu
136	Abhishek	Gupta	The Ohio State University	gupta.706@osu.edu

#	First Name	Last Name	Affiliation	Email
137	Vijay	Gupta	University of Notre Dame	vgupta2@nd.edu
138	Samuel	Guyer	Tufts University	sguyer@cs.tufts.edu
139	Jin-Oh	Hahn	University of Maryland	jhahn12@umd.edu
140	Bruce	Hamilton	National Science Foundation	bhamilto@nsf.gov
141	Qi	Han	Colorado School of Mines	qhan@mines.edu
142	Yi	Han	Rutgers University	yh482@rutgers.edu
143	Michael	Hannigan	University of Colorado	hannigan@colorado.edu
144	Gaby Joe	Hannoun	Virginia Tech	gabyjoe@vt.edu
145	Hamed	Hassani	University of Pennsylvania	hassani@seas.upenn.edu
146	John	Hatcliff	Kansas State University	hatcliff@ksu.edu
147	Liang	He	University of Colorado Denver	liang.he@ucdenver.edu
148	Tian	He	University of Minnesota	tianhe@umn.edu
149	Zhihai	He	University of Missouri	hezhi@missouri.edu
150	Christoffer	Heckman	University of Colorado Boulder	christoffer.heckman @colorado.edu
151	Joao	Hespanha	UCSB	hespanha@ece.ucsb.edu
152	Payam	Heydari	University of California, Irvine	payam@uci.edu
153	Sandra	Hnat	Case Western Reserve University	skh63@case.edu
154	Mark	Ho	UC Berkeley	mark_ho@berkeley.edu
155	Dezhi	Hong	UC San Diego	dzhong1989@gmail.com
156	Tom	Hou	Virginia Tech	thou@vt.edu
157	Amir	Houmansadr	University of Massachusetts Amherst	amir@cs.umass.edu
158	Naira	Hovakimyan	University of Illinois at Urbana-Champaign	nhovakim@illinois.edu
159	Danny Yuxing	Huang	Princeton University	yuxingh@cs.princeton.edu
160	Qiang	Huang	University of Southern California	qiang.huang@usc.edu
161	Robert	Iannucci	Carnegie Mellon University	bob.iannucci@sv.cmu.edu
162	Inigo	Incer Romeo	University of California, Berkeley	inigo@eecs.berkeley.edu
163	Petros	Ioannou	University of Southern California	ioannou@usc.edu
164	Murtuza	Jadliwala	University of Texas at San Antonio	murtuza.jadliwala@utsa.edu
165	Hamidreza	Jafarnejadsani	University of Illinois at Urbana-Champaign	hamid.jafarnejad@gmail.com
166	Luis	Jaimes	Florida Polytechnic University	ljaimes@floridapoly.edu
167	Rishee	Jain	Stanford University	rishee.jain@stanford.edu
168	Kuk	Jang	University of Pennsylvania	jangkj@seas.upenn.edu
169	Jinyong	Jeong	University of Pittsburgh	sapiyong@gmail.com
170	Seongwoon	Jeong	Stanford University	swjeong3@stanford.edu

REGISTRANTS

#	First Name	Last Name	Affiliation	Email
171	Susmit	Jha	SRI International	susmit.kumar.jha@gmail.com
172	Yunyi	Jia	Clemson University	yunyij@clemson.edu
173	Hongrui	Jiang	University of Wisconsin - Madison	hongrui@engr.wisc.edu
174	Xuzhou	Jiang	Georgia Tech	xjiang@gatech.edu
175	Yier	Jin	University of Florida	yier.jin@ece.ufl.edu
176	Ramesh	Johari	Stanford University	rjohari@stanford.edu
177	Blake	Johnson	Virginia Tech	bnj@vt.edu
178	Neil	Johnson	George Washington University	neiljohnson@gwu.edu
179	George	Kantor	Carnegie Mellon University	kantor@ri.cmu.edu
180	Soummya	Kar	Carnegie Mellon University	soummyak@andrew.cmu.edu
181	Sertac	Karaman	MIT	sertac@mit.edu
182	Amy	Karns	Vanderbilt University, ISIS	amy.l.karns@vanderbilt.edu
183	Zak	Kassas	University of California, Irvine	zkassas@ece.ucr.edu
184	Rajesh	Kavasseri	North Dakota State University	rajesh.kavasseri@ndsu.edu
185	Kerry	Kelly	University of Utah	kerry.kelly@utah.edu
186	Mehdi	Khandani	Resensys LLC	mehdi@resensys.com
187	Frankie	King	Vanderbilt University, ISIS	frankie.king@vanderbilt.edu
188	Adam	Kinney	NCO/NITRD	kinney@nitrd.gov
189	Mithat	Kisacikoglu	University of Alabama	mkisacik@ua.edu
190	Ross	Knepper	Cornell University	rak@cs.cornell.edu
191	Woo-Hyun	Ko	Texas A&M University	whko@tamu.edu
192	Marin	Kobilarov	Johns Hopkins University	marin@jhu.edu
193	Zhenyu	Kong	Virginia Tech	zkong@vt.edu
194	Oliver	Kosut	Arizona State University	okosut@asu.edu
195	Xenofon	Koutsoukos	Vanderbilt University, ISIS	Xenofon.Koutsoukos @vanderbilt.edu
196	Veronika	Kovacova	Pennsylvania State Univeristy	veronika@kovacova.fr
197	Hadas	Kress-Gazit	Cornell University	hadaskg@cornell.edu
198	Perinkulam	Krishnaprasad	University of Maryland	krishna@isr.umd.edu
199	David	Kuehn	FHWA	DAVID.KUEHN@DOT.GOV
200	Panganamala	Kumar	Texas A&M University	prk@tamu.edu
201	Vijay	Kumar	University of Pennsylvania	vijay.kumar@seas.upenn.edu
202	James	Kurose	National Science Foundation	jkurose@nsf.gov
203	Alex	Labrinidis	University of Pittsburgh	labrinid@cs.pitt.edu
204	Denise	Lach	Oregon State University	denise.lach@oregonstate.edu

#	First Name	Last Name	Affiliation	Email
205	John	Lach	University of Virginia	jlach@virginia.edu
206	Stephane	Lafortune	University of Michigan	stephane@umich.edu
207	Nizar	Lajnef	Michigan State University	lajnefni@msu.edu
208	Sanjay	Lall	Stanford	lall@stanford.edu
209	Robert	Landers	National Science Foundation	rlanders@nsf.gov
210	Kincho	Law	Stanford University	law@stanford.edu
211	Loukas	Lazos	University of Arizona	llazos@email.arizona.edu
212	Edward	Lee	UC Berkeley	eal@berkeley.edu
213	Insup	Lee	University of Pennsylvania	lee@cis.upenn.edu
214	Ming	Leu	Missouri University of Science and Technology	mleu@mst.edu
215	Kirill	Levchenko	University of Illinois	klevchen@illinois.edu
216	Husheng	Li	The Uniersity of Tennessee	hli31@utk.edu
217	Wenchao	Li	Boston University	wenchao@bu.edu
218	Hyunkyung	Lim	Stony Brook University	hyulim@gmail.com
219	Mikael	Lindvall	Fraunhofer USA	mikli@fc-md.umd.edu
220	Chen-Ching	Liu	Virginia Tech	ccliu@vt.edu
221	Xin	Liu	Arizona State University	xliu272@asu.edu
222	Edgar	Lobaton	North Carolina State University	edgar.lobaton@ncsu.edu
223	Chenyang	Lu	Washington University in St. Louis	lu@cse.wustl.edu
224	Yang	Lu	Pennsylvania State University	lubingwu88@gmail.com
225	Marcus	Lucas	UCLA	maluc@g.ucla.edu
226	Jack	Lutz	Iowa State University	lutz@iastate.edu
227	Robyn	Lutz	Iowa State University	rlutz@iastate.edu
228	Jerome	Lynch	University of Michigan	jerlynch@umich.edu
229	Roman	Lysecky	University of Arizona	rlysecky@ece.arizona.edu
230	Kaveri	Mahapatra	Penn State University	kzm221@psu.edu
231	Nina	Mahmoudian	Michigan Tech	ninam@mtu.edu
232	Enrique	Mallada	Johns Hopkins University	mallada@jhu.edu
233	Rahul	Mangharam	University of Pennsylvania	rahulm@seas.upenn.edu
234	Kunal	Mankodiya	University of Rhode Island	kunalm@uri.edu
235	Pedro	Manrique	University of Miami	p.manriquecharry@umiami.edu
236	Zhi-Hong	Mao	University of Pittsburgh	zhm4@pitt.edu
237	Darko	Marinov	University of Illinois at Urbana-Champaign	marinov@illinois.edu
238	Nuno	Martins	University of Maryland at College Park	nmartins@umd.edu

REGISTRANTS

#	First Name	Last Name	Affiliation	Email
239	Margaret	Martonosi	Princeton University	mrm@princeton.edu
240	Neda	Masoud	University of Michigan Ann Arbor	nmasoud@umich.edu
241	Dan	Massey	University of Colorado Boulder	daniel.massey@colorado.edu
242	Donatello	Materassi	University of Tennessee	dmateras@utk.edu
243	Johanna	Mathieu	University of Michigan	jlmath@umich.edu
244	Aditya	Mathur	Purdue University	apm@cs.purdue.edu
245	Sudip	Mazumder	University of Illinois at Chicago	mazumder@uic.edu
246	Shawn	McDonnell	Embry–Riddle Aeronautical University	mcdonnes@my.erau.edu
247	Bruce	McMillin	Missouri University of Science and Technology	ff@mst.edu
248	Noushin	Mehdipour	Boston University	noushinm@bu.edu
249	Ali	Mehrizi-Sani	Washington State University	mehrizi@wsu.edu
250	Sharad	Mehrotra	University of California at Irvine	sharad@ics.uci.edu
251	Olov	Meijer	Vanderbilt University, ISIS	patrik.meijer@vanderbilt.edu
252	Sandipan	Mishra	Rensselaer Polytechnic Institute	sandipanmishra@gmail.com
253	Urbashi	Mitra	University of Southern California	ubli@usc.edu
254	Sibin	Mohan	University of Illinois at Urbana-Champaign	sibin@illinois.edu
255	Ted	Morris	University of Minnesota	ted.morris@gmail.com
256	Bashir	Morshed	The University of Memphis	bmorshed@memphis.edu
257	Mojtaba	Mozaffar	Northwestern University	MojtabaMozaffar2020 @u.northwestern.edu
258	Todd	Murphey	Northwestern University	t-murphey@northwestern.edu
259	Pamela	Murray-Tuite	Clemson University	pmmurra@clemson.edu
260	Matt	Mutka	National Science Foundation	mmutka@nsf.gov
261	Charlie	Mydlarz	New York University	cmydlarz@nyu.edu
262	Mark	Nandor	Case Western Reserve University	mjn18@case.edu
263	Srinivasa	Narasimhan	Carnegie Mellon University	srinivas@cs.cmu.edu
264	Erickson	Nascimento	UC Berkeley	erickson@dcc.ufmg.br
265	Balasubramaniam	Natarajan	Kansas State University	bala@ksu.edu
266	Sandeep	Neema	DARPA	sandeep.neema@darpa.mil
267	Daniel	Newman	Georgia Institute of Technology	danielnewman@gatech.edu
268	Wendy	Nilsen	National Science Foundation	wnilsen@nsf.gov
269	Branislav	Notaros	Colorado State University	notaros@colostate.edu
270	Hossein	Nourkhiz Mahjoub	University of Central Florida	hnmahjoub@knights.ucf.edu

#	First Name	Last Name	Affiliation	Email
271	Pierluigi	Nuzzo	University of Southern California	nuzzo@usc.edu
272	Cagdas	Onal	Worcester Polytechnic Institute	cdonal@wpi.edu
273	Alex	Orailoglu	UC San Diego	alex@cs.ucsd.edu
274	Nathan	Otterness	University of North Carolina at Chapel Hill	otternes@cs.unc.edu
275	Pratham	Oza	Virginia Tech	prathamo@vt.edu
276	Umit	Ozguner	Ohio State University	ozguner.1@osu.edu
277	Taskin	Padir	Northeastern University	t.padir@northeastern.edu
278	Anill	Pahwa	National Science Foundation	apahwa@nsf.gov
279	Miroslav	Pajic	Duke University	miroslav.pajic@duke.edu
280	Miao	Pan	University of Houston	mpan2@uh.edu
281	Christos	Papadopoulos	DHS	christos.papadopoulos @hq.dhs.gov
282	Nikolaos	Papanikolopoulos	University of Minnesota	npapas@cs.umn.edu
283	George	Pappas	University of Pennsylvania	pappasg@seas.upenn.edu
284	Sudeep	Pasricha	Colorado State University	sudeep@colostate.edu
285	Vidyut	Patel	FAA	vidyut.patel@faa.gov
286	Nilavra	Pathak	University of Maryland Baltimore County	nilavra1@umbc.edu
287	Marco	Pavone	Stanford University	pavone@stanford.edu
288	Matthew	Peet	Arizona State University	mpeet@asu.edu
289	Kirstin	Petersen	Cornell University	Kirstin@cornell.edu
290	Pierluigi	Pisu	Clemson University	pisup@clemson.edu
291	Andre	Platzer	Carnegie Mellon University	jpacker@cs.cmu.edu
292	Dario	Pompili	Rutgers University	pompili@rutgers.edu
293	Radha	Poovendran	University of Washington	Chair@ece.uw.edu
294	Adam	Porter	University of Maryland	aporter@cs.umd.edu
295	Bradley	Potteiger	Vanderbilt University, ISIS	bradley.d.potteiger @vanderbilt.edu
296	Pavithra	Prabhakar	Kansas State University	pprabhakar@ksu.edu
297	Atul	Prakash	University of Michigan	aprakash@umich.edu
298	Zhen	Qian	Carnegie Mellon University	seanqian@cmu.edu
299	Qinru	Qiu	Syracuse University	qinru.qiu@gmail.com
300	Brendan	Quinlivan	Harvard University	bquinlivan@g.harvard.edu
301	Roger	Quinn	Case Western Reserve Univ.	rdq@case.edu
302	Vidya	Raju	University of Maryland, College Park	rajuv@umd.edu

REGISTRANTS

#	First Name	Last Name	Affiliation	Email
303	Umakishore	Ramachandran	Georgia Institute of Technology	rama@gatech.edu
304	Prahalada	Rao	University of Nebraska-Lincoln	rao@unl.edu
305	Hossein	Rastgoftar	University of Michigan Ann Arbor	hosseinr@umich.edu
306	Lillian	Ratliff	University of Washington	ratliffl@uw.edu
307	Yosef	Razin	Georgia Institute of Technology	yrazin@gatech.edu
308	Stephen	Rees	Vanderbilt University, ISIS	stephen.a.rees@vanderbilt.edu
309	Phillip	Regalia	National Science Foundation	pregalia@nsf.gov
310	Shangping	Ren	San Diego State University	sren@sdsu.edu
311	Mark	Rentschler	University of Colorado at Boulder	mark.rentschler@colorado.edu
312	Yeonwoo	Rho	Michigan Technological University	yrho@mtu.edu
313	Hanz	Richter	Cleveland State University	h.richter@csuohio.edu
314	Katherina	Rodriguez	Vanderbilt University, ISIS	katherina.a.rodriguez@ vanderbilt.edu
315	Sujit	Rokka Chhetri	UC Irvine	schhetri@uci.edu
316	Sandip	Roy	Sandip Roy	sroyeecs@gmail.com
317	Amit	Roy-Chowdhury	University of California, Riverside	amitrc@ece.ucr.edu
318	Walid	Saad	Virginia Tech	walids@vt.edu
319	Arman	Sabbaghi	Purdue University	sabbaghi@purdue.edu
320	Dorsa	Sadigh	Stanford University	dorsa@cs.stanford.edu
321	Abhijeet	Sahu	Texas A&M University	abhijeet_ntpc@tamu.edu
322	Zachary	Saidman	Embry-Riddle Aeronautical University	saidmanz@my.erau.edu
323	Murti	Salapaka	University Of Minnesota, Twin-Cities	murtis@umn.edu
324	Christopher	Saldana	Georgia Institute of Technology	christopher.saldana @me.gatech.edu
325	Alejandro Miguel	San Martin	JPL/NASA	Alejandro.M.Sanmartin @jpl.nasa.gov
326	Ricardo	Sanfelice	University of California, Santa Cruz	ricardo@ucsc.edu
327	Lalitha	Sankar	Arizona State University	lsankar@asu.edu
328	Stefano	Sapienza	Motion Analysis Lab, Spaulding Rehabilitation Hospital	ssapienza@partners.org
329	Soumik	Sarkar	Iowa State University	soumiks@iastate.edu
330	Arif	Sarwat	Florida International University	asarwat@fiu.edu
331	Christopher	Scully	US Food and Drug Administration	christopher.scully@fda.hhs.gov
332	Benjamin	Seibold	Temple University	seibold@temple.edu

#	First Name	Last Name	Affiliation	Email
333	Sanjit	Seshia	UC Berkeley	sseshia@eecs.berkeley.edu
334	Ajay	Sharda	Kansas State University	asharda@ksu.edu
335	Nitin	Sharma	University of Pittsburgh	nis62@pitt.edu
336	Kelly	Shaw	University of Richmond	kshaw@richmond.edu
337	Prashant	Shenoy	University of Massachusetts Amherst	shenoy@cs.umass.edu
338	Kang	Shin	The University of Michigan	kgshin@umich.edu
339	Yasser	Shoukry	University of Maryland, College Park	yshoukry@ece.umd.edu
340	Aviral	Shrivastava	Arizona State University	Aviral.Shrivastava@asu.edu
341	Siddhartha	Sikdar	George Mason University	ssikdar@gmu.edu
342	Simone	Silvestri	University of Kentucky	silvestri@cs.uky.edu
343	Tonya	Smith-Jackson	National Science Foundation	tsmithja@nsf.gov
344	Scott	Smolka	Stony Brook University	sas@cs.stonybrook.edu
345	Andreas	Spanias	Arizona State University	spanias@asu.edu
346	Jonathan	Sprinkle	National Science Foundation	jsprinkl@nsf.gov
347	Anurag	Srivastava	Washington State University	anurag.k.srivastava@wsu.edu
348	Mani	Srivastava	UCLA	mbs@ucla.edu
349	Milutin	Stanacevic	Stony Brook University (SUNY)	milutin.stanacevic @stonybrook.edu
350	John	Stankovic	University of Virginia	stankovic@cs.virginia.edu
351	Raphael	Stern	Vanderbilt University, ISIS	stern5@illinois.edu
352	Cynthia	Sturton	University of North Carolina at Chapel Hill	csturton@cs.unc.edu
353	Xiaowu	Sun	University of Maryland, College Park	xsun24@terpmail.umd.edu
354	Ye	Sun	Michigan Technological University	yes@mtu.edu
355	Zhi	Sun	University at Buffalo, State University of New York	zhisun@buffalo.edu
356	Shreyas	Sundaram	Purdue University	sundara2@purdue.edu
357	Vivienne	Sze	Massachusetts Institute of Technology	sze@mit.edu
358	Mario	Sznaier	Northeastern University	msznaier@coe.neu.edu
359	Janos	Sztipanovits	Vanderbilt University, ISIS	janos.sztipanovits @vanderbilt.edu
360	Paulo	Tabuada	UCLA	tabuada@ucla.edu
361	Patrick	Tague	Carnegie Mellon University	tague@cmu.edu
362	Robert	Tamburo	Carnegie Mellon University	rtamburo@cmu.edu
363	Xiaobo	Tan	Michigan State University	xbtan@egr.msu.edu
364	Jiong	Tang	University of Connecticut	jiong.tang@uconn.edu

REGISTRANTS

#	First Name	Last Name	Affiliation	Email
365	Yujie	Tang	California Institute of Technology	ytang2@caltech.edu
366	Chee-Wooi	Ten	Michigan Technological University	ten@mtu.edu
367	Hal S.	Tharp	University of Arizona	tharp@ece.arizona.edu
368	Steven	Thomson	USDA- NIFA	steven.j.thomson@nifa.usda.gov
369	Ali	Tivay	University of Maryland	tivay@umd.edu
370	Ufuk	Topcu	The University of Texas at Austin	utopcu@utexas.edu
371	Matthew	Travers	Carnegie Mellon University	mtravers@andrew.cmu.edu
372	Nikolaos	Tsekos	University of Houston	nvtsekos@central.uh.edu
373	Panagiotis	Tsiotras	Georgia Tech	tsiotras@gatech.edu
374	Pavan	Turaga	Arizona State University	pturaga@asu.edu
375	Nasim	Uddin	University of Alabama at Birmingham	nuddin@uab.edu
376	Kimon	Valavanis	University of Denver	kimon.valavanis@du.edu
377	Kyriakos	Vamvoudakis	Georgia Tech	kyriakos@gatech.edu
378	Kari	Van Grinsven	University of Wisconsin-Madison	kvangrinsven@wisc.edu
379	Chris	vanBuskirk	Vanderbilt University, ISIS	christopher.p.van.buskirk @vanderbilt.edu
380	Patricio	Vela	Georgia Inst. of Technology	pvela@gatech.edu
381	Isidore	Venetos	FAA	Isidore.Venetos@faa.gov
382	Nalini	Venkatasubramanian	University of California, Irvine	nalini@uci.edu
383	Richard	Voyles	Purdue University	rvoyles@purdue.edu
384	Ralph	Wachter	National Science Foundation	rwachter@nsf.gov
385	Conor	Walsh	Harvard University	Walsh@seas.harvard.edu
386	Yan	Wan	University of Texas at Arlington	yan.wan@uta.edu
387	Junmin	Wang	University of Texas at Austin	jwang@austin.utexas.edu
388	Lingfeng	Wang	University of Wisconsin-Milwaukee	wang289@uwm.edu
389	Pu	Wang	UNC Charlotte	pwang13@uncc.edu
390	shige	wang	General Motors Global R&D	shige.wang@gm.com
391	Albert	Wavering	NIST	wavering@nist.gov
392	Peng	Wei	Iowa State University	pwei@iastate.edu
393	James	Weimer	University of Pennsylvania	weimerj@seas.upenn.edu
394	Brent	Wells	US Agency for International Development	brewells@usaid.gov
395	Jules	White	Vanderbilt University	jules@dre.vanderbilt.edu
396	Ryan	Williams	Virginia Tech	rywilli1@vt.edu

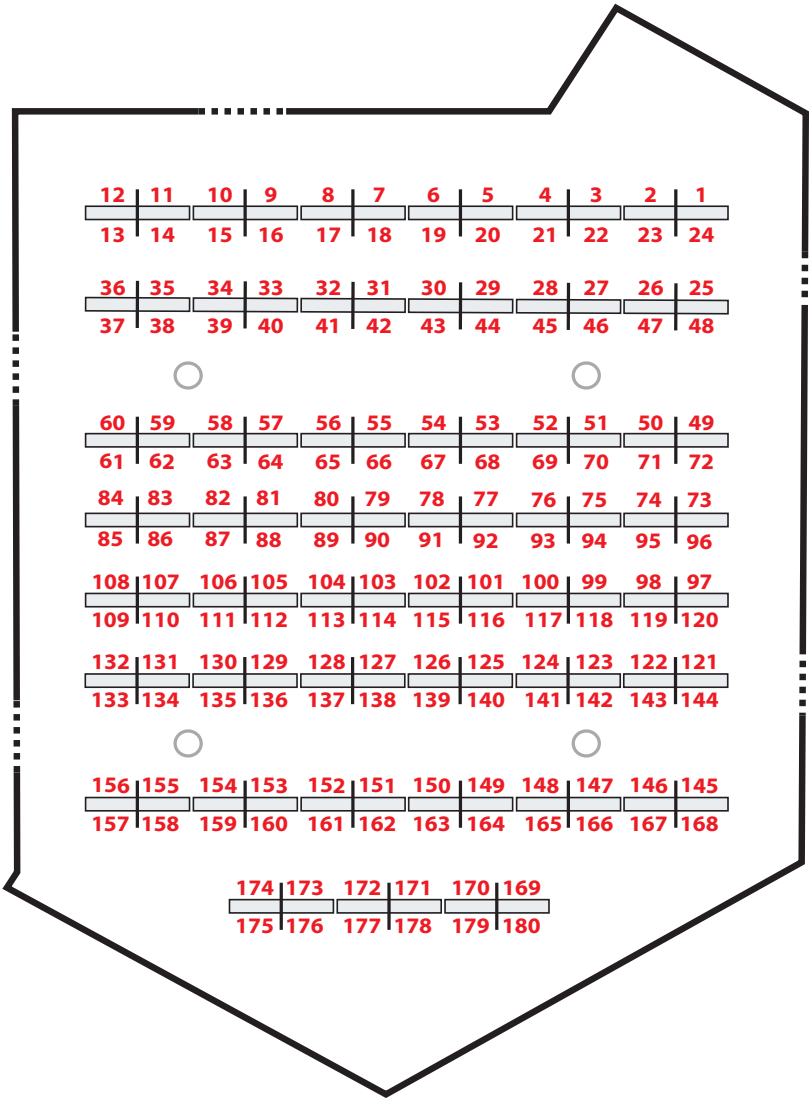
#	First Name	Last Name	Affiliation	Email
397	Dan	Wolf	Cyber Pack Ventures	Daniel.G.Wolf@gmail.com
398	Dan	Work	Vanderbilt University, ISIS	dan.work@vanderbilt.edu
399	Jie	Wu	The University of Tennessee	jaynewu@utk.edu
400	Wencen	Wu	San Jose State University	wencen.wu@sjsu.edu
401	Zhuangdi	Xu	Georgia Institute of Technology	xzdandy@gatech.edu
402	Chengmo	Yang	University of Delaware	chengmo@udel.edu
403	Ming	Yang	The University of North Carolina at Chapel Hill	yang@cs.unc.edu
404	Lei	Ying	Arizona State University	lei.ying.2@asu.edu
405	Wei	Yu	Towson University	wyu@towson.edu
406	Joseph	Zambreno	Iowa State University	zambreno@iastate.edu
407	Hitten	Zaveri	Yale University	hitten.zaveri@yale.edu
408	Michael	Zavlanos	Duke University	michael.zavlanos@duke.edu
409	Baosen	Zhang	University of Washington	zhangbao@uw.edu
410	Liang	Zhang	University of Connecticut	liang.zhang@uconn.edu
411	Michael	Zhang	University of California Davis	hmzhang@ucdavis.edu
412	Wei	Zhang	Ohio State University	zhang.491@osu.edu
413	Xuan	Zhang	Washington University in St. Louis	xuan.zhang@wustl.edu
414	Ying	Zhang	Georgia Institute of Technology	yzhang@gatech.edu
415	Y. Rosa	Zheng	Lehigh University	yrz218@lehigh.edu
416	Minghui	Zhu	Pennsylvania State University	muz16@psu.edu
417	Qi	Zhu	Northwestern University	qzhu@northwestern.edu
418	Quanyan	Zhu	New York University	qz494@nyu.edu
419	Michael	Zink	University of Massachusetts Amherst	zink@ecs.umass.edu
420	Michal	Ziv-El	National Science Foundation	mzivel@nsf.gov
421	Saman	Zonouz	Rutgers University	samance@gmail.com

POSTER SESSION DIAGRAMS

current as of 11/6/18

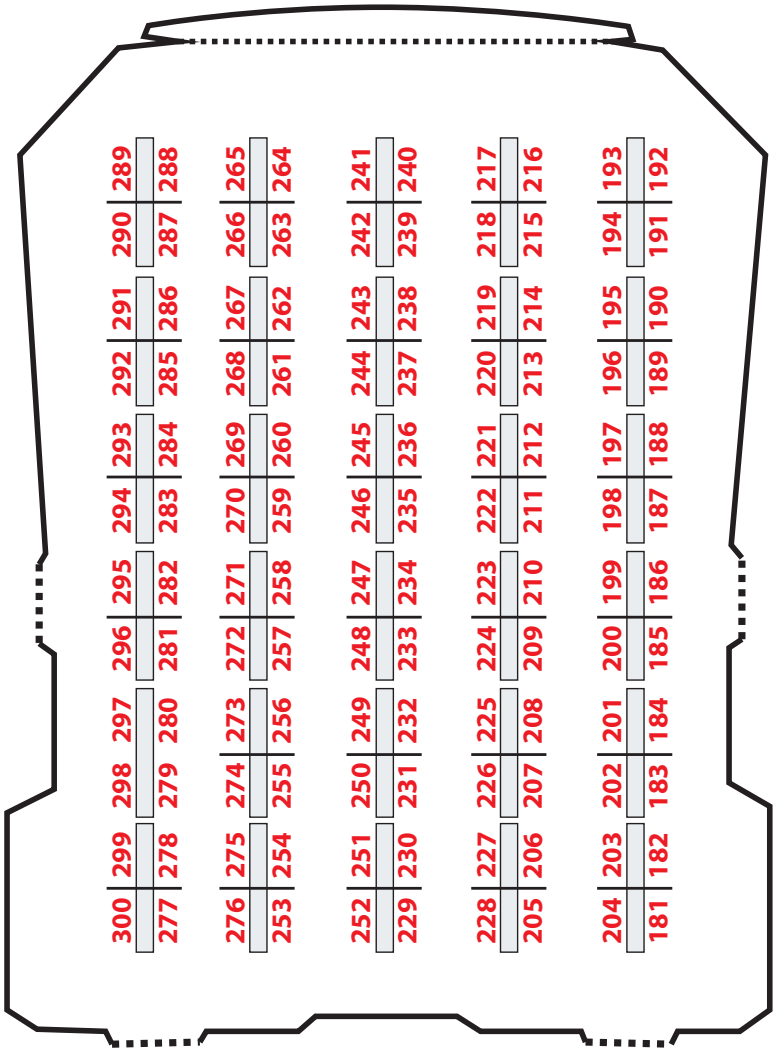
POSTER SESSION FLOOR PLAN

TERRACE BALLROOM



POSTER SESSION FLOOR PLAN

MAGNOLIA BALLROOM

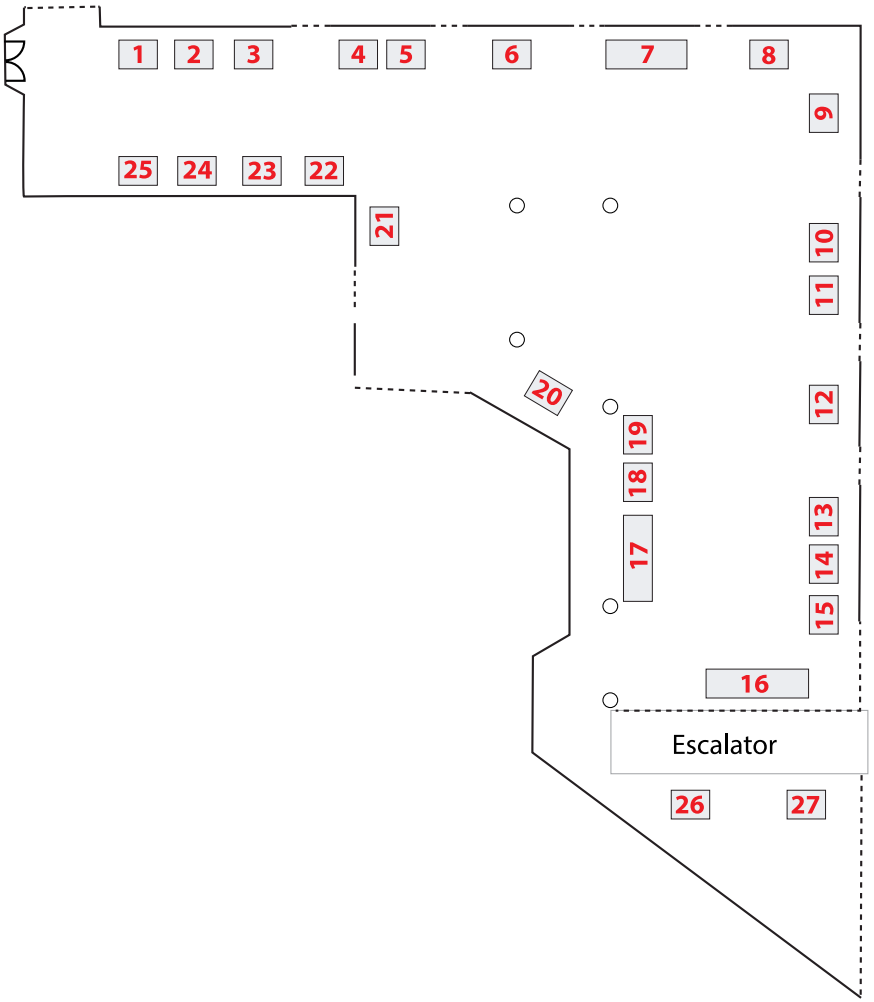


DEMO SESSION DIAGRAM/ PARTICIPANTS

current as of 11/7/18

DEMONSTRATION SESSION FLOOR PLAN

PLAZA BALLROOM FOYER



DEMONSTRATION SESSION PARTICIPANTS

CURRENT AS OF 11/8/18

Loc #	PI	Co-Presenters	Affiliation	Project Title	Project Award #
1	Sanjit Seshia	Daniel Fremont	University of California, Berkeley	CPS: Breakthrough: Control Improvisation for Cyber-Physical Systems	1646208
2	Siddhartha Sikdar	Biswarup Mukherjee, Shriniwas Patwardhan, Ananya Dhawan	George Mason University	CPS: Synergy: A Novel Biomechatronic Interface Based on Wearable Dynamic Imaging Sensors	1329829, 1646204
3	Thidapat (Tam) Chantem	Pratham Oza, Mahsa Foruhandeh	Virginia Tech	CPS: Synergy: Collaborative Research: Semi-Automated Emergency Response System	1658225
4	Neil Johnson	Pedro Manrique	George Washington University	CPS: Breakthrough: Understanding Sub-Second Instabilities in a Global Cyber-Physical System	1522693
5	Kunal Mankodiya	Nick Constant	University of Rhode Island	CAREER: CPS: Internet of Wearable E-Textiles for Telemedicine	1652538
6	Lalitha Sankar	Oliver Kosut	Arizona State University	CPS: TTP Option: Synergy: A Verifiable Framework for Cyber- Physical Attacks and Countermeasures in a Resilient Electric Power Grid	1449080
7	Janos Sztipanovits		Vanderbilt University	Cyber-Physical Systems Virtual Organization: Active Resources	1521617
8	Hongrui Jiang	Kari Van Grinsven	University of Wisconsin - Madison	CPS: Synergy: Smart Flexible Camera Sheet: Ultra-Thin Semantic-Guided Cooperative Micro-Camera Array	1329481
9	Chris Saldana	Daniel Newman	Georgia Institute of Technology	CPS: Synergy: CNC Process Plan Simulation, Automation and Optimization	1646013
10	Ragunathan (Raj) Rajkumar	Sandeep Dsouza	Carnegie Mellon University	CPS: Frontiers: Collaborative Research: ROSELINE: Enabling Robust, Secure and Efficient Knowledge of Time Across the System Stack	1329644
11	Srinivasa Narasimhan	Robert Tamburo	Carnegie Mellon University	CPS: Synergy: TTP Option: Anytime Visual Scene Understanding for Heterogeneous and Distributed Cyber-Physical Systems	1446601
12	Zak Kassas		University of California, Irvine	CAREER: Situational Awareness Strategies for Autonomous Systems in Dynamic Uncertain Environments	1751205, 1566240
13	Y. Rosa Zheng	Mohammadhossein Behgam	Lehigh University	CPS: Synergy: Collaborative Research: DEUS: Distributed, Efficient, Ubiquitous and Secure Data Delivery Using Autonomous Underwater Vehicles	1853257
14	Yasser Shoukry	Xiaowu Sun, Vidya Raju	University of Maryland, College Park	CPS: Medium: Resilient-by-Cognition Cyber-Physical Systems	1837589
15	Umakishore Ramachandran	Zhuangdi Xu	Georgia Institute of Technology	CPS: Breakthrough: Programming and Execution Environment for Geo-Distributed Latency-Sensitive Applications	1446801
16	Mani Srivastava		UCLA	CPS: Frontiers: Collaborative Research: ROSELINE: Enabling Robust, Secure and Efficient Knowledge of Time Across the System Stack	1329755
17	Alex Labrinidis	Kristi Bushman; Jinyong Jeong	University of Pittsburgh	CPS: TTP Option: Medium: Building a Smart City Economy and Information Ecosystem to Motivate Pro-Social Transportation Behavior	1739413
18	Juan Pablo Bello	Charlie Mydlarz	New York University	CPS: Frontier: SONYC: A Cyber-Physical System for Monitoring, Analysis and Mitigation of Urban Noise Pollution	1544753
19	Miriah Meyer (PI, not presenting)	Kerry Kelly (co PI presenting)	University of Utah	CPS: Synergy: A Layered Framework of Sensors, Models, Land-Use Information and Citizens for Understanding Air Quality in Urban Environments	1646408
20	Bashir Morshed		The University of Memphis	Events-of-interest Capture Using Novel Body-worn Fully-passive Wireless Sensors for S&CC	1637250
21	Daniel Work	Benjamin Seibold, Benedetto Piccoli, Roman Lysecky	Vanderbilt University	CPS: Synergy: Collaborative Research: Control of Vehicular Traffic Flow via Low Density Autonomous Vehicles	1446702, 1446690, 1445715, 1446435
22	Yan Wan		University of Texas at Arlington	CAREER: Co-Design of Networking and Decentralized Control to Enable Aerial Networks in an Uncertain Airspace	1714519
23	Amit K. Roy Chowdhury	Abdelrahman Fahim	University of California, Riverside	CPS: Synergy: Collaborative Research: Extracting Time-Critical Situational Awareness from Resource Constrained Networks	1544969
24	Manimaran Govindarasu	Gelli Ravikumar	Iowa State University	CPS: Synergy: High-Fidelity, Scalable, Open-Access Cyber Security Testbed for Accelerating Smart Grid Innovations and Deployments	1446831
25	Nick Feamster	Danny Y. Huang	Princeton	CPS: Medium: Detecting and Controlling Unwanted Data Flows in the Internet of Things	1739809
26	Roger Quinn		Case Western Reserve University	CPS: Medium: Integrated control of biological and mechanical power for standing balance and gait stability after paralysis	1739800
27	Xenofon Koutsoukos	Bradley Potteiger	Vanderbilt University	CPS: Small: Integrated Reconfigurable Control and Moving Target Defense for Secure Cyber-Physical Systems	1739328

AREA DINING DIRECTORY

AREA DINING DIRECTORY

FINN AND PORTER
American, Seafood
Located in Hotel

SUSHI BAR
Located in Hotel

CLYDE'S AT MARK CENTER
American
1700 North Beauregard Street
Alexandria, Virginia
0.4 miles from Hotel
703-820-8300

THAI IN SHIRLINGTON
4029 28th Street South
Shirlington Village
Arlington, Virginia
1.6 miles from Hotel
703-931-3203

ENAT KITFO
Ethiopian
4709 North Chambliss Street
Alexandria, Virginia
2.0 miles from Hotel
703-642-3628

VALENTINO'S NEW YORK STYLE
Italian, Pizza
4813 Beauregard Street
Alexandria, Virginia
2.1 miles from Hotel
703-354-8383

ATLANTIS PIZZERIA AND FAMILY RESTAURANT
Mediterranean
3648 King Street
Alexandria, Virginia
2.2 miles from Hotel
703-671-0250

BUSBOYS AND POETS
American, International
4521 South Campbell Avenue
Arlington, Virginia 22206
2.3 miles from Hotel
703-379-9756

CARLYLE
American, Vegetarian Friendly
4000 Campbell Avenue
Arlington, Virginia
2.5 miles from Hotel
703-931-0777

CAPITAL CITY BREWING COMPANY
American, Pub
4001 Campbell Avenue
Arlington, Virginia
2.6 miles from Hotel
703-578-3888

AREA DINING DIRECTORY

OSTERIA DA NINO
Italian, Mediterranean
2900 South Quincy Stree
The Village at Shirlington
Arlington, Virginia
2.6 miles from Hotel
703-820-1128

COPPERWOOD TAVERN
American
4021 Campbell Avenue
Arlington, Virginia
2.6 miles from Hotel
703-552-8010

PALETTE 22
American
4021 Campbell Avenue
Arlington, Virginia
2.6 miles from Hotel
703-552-8010

AROMA INDIAN RESTAURANT
4052 Campbell Avenue
Arlington, Virginia
2.6 miles from Hotel
703-575-8800

LOCAL ATTRACTIONS

LOCAL ATTRACTIONS

THE PHILLIPS COLLECTION
1600 21st St NW, Washington, DC 20009
(202) 387-2151
Admission: $12.00 adults; $10.00 students
Hours: Tuesday -Saturday 10 AM- 5 PM;
Thursday 10 AM-8:30 PM
Metro Stop: Dupont Circle Station - Q Street exit

INTERNATIONAL SPY MUSEUM
800 F St NW, Washington, DC 20004
(202) 393-7798
Admission: $20.95
Hours: Sunday-Saturday 10 AM-7 PM
Metro Stop: Gallery Place/Chinatown
Metrorail Station

SMITHSONIAN NATIONAL ZOOLOGICAL PARK
3001 Connecticut Ave NW, Washington, DC 20008
(202) 633-4888
Admission: Free
Hours: Sunday-Saturday 10 AM-4:30 PM
Metro Stop: Woodley Park-Zoo/Adams Morgan or Cleveland Park

JOHN F. KENNEDY CENTER FOR THE PERFORMING ARTS
2700 F St NW, Washington, DC 20566
(202) 416-8000
Admission: Walk-in tours are free
Hours: Monday-Friday 10 AM-5 PM;
Saturday & Sunday 10 AM -5 PM
Metro Stop: The Foggy Bottom/George Washington
University Station

NATIONAL GALLERY OF ART
6th and Constitution Ave NW, Washington, DC 20565
(202) 737-4215
Admission: Free
Hours: Monday-Saturday 10 AM. - 5 PM.;
Sunday: 11 AM - 6 PM
Metro Stop: Judiciary Square on the Red Line; Archives-Penn Quarter-Navy Memorial on the Yellow/Green Lines; and Smithsonian on the Blue/Orange Lines

SMITHSONIAN NATIONAL MUSEUM OF AMERICAN HISTORY
14th St and Constitution Ave, NW,
Washington, DC 20001
(202) 633-1000
Admission: Free
Hours: Sunday-Saturday 10:00 AM - 5:30 PM
Metro Stop: The Federal Triangle and Smithsonian Stations

LINCOLN MEMORIAL
2 Lincoln Memorial Cir NW, Washington, DC 20037
(202) 426-6841
Admission: Free
Hours: Sunday-Saturday 24 Hours
Metro Stop: Foggy Bottom

WORLD WAR II MEMORIAL
17th St SW, Washington, DC 20006
(202) 426-6841
Admission: Free
Hours: Sunday-Saturday 24 Hours
Metro Stop: Smithsonian Station

LOCAL ATTRACTIONS

FRANKLIN DELANO ROOSEVELT MEMORIAL
1850 West Basin Dr. SW, Washington, DC 20242
(202) 426-6841
Admission: Free
Hours: Sunday-Saturday 24 Hours
Metro Stop: Smithsonian Station

KOREAN WAR VETERANS MEMORIAL
900 Ohio Dr. SW, Washington, DC 20024
(202) 426-6841
Admission: Free
Hours: Sunday-Saturday 24 Hours
Metro Stop: Foggy Bottom Station

NATIONAL AIR AND SPACE MUSEUM
600 Independence Avenue SW, Washington DC 20560
(202) 633-2214
Admission: Free
Hours: Sunday-Saturday 10 AM-5:30 PM
Metro Stop: L'Enfant Plaza

LIBRARY OF CONGRESS
101 Independence Avenue SW, Washington DC 20540
Admission: Free
Hours: Monday-Saturday 8:30 AM-4:30 PM; Sunday, Closed
Metro Stop: Capitol South

TRAVEL DIRECTIONS

TRAVEL DIRECTIONS

FROM DULLES AIRPORT:
Depart Saarinen Circle toward Copilot Way (0.2 mi.)
Keep left to stay on Saarinen Circle (0.5 mi.)
Keep right onto Dulles Airport Access Rd (12.1 mi.)
Take ramp right for VA-267 E toward Bethesda / Chain Br Rd / McLean (1.0 mi.)
At exit 18A, take ramp right for I-495 South toward Richmond (11.4 mi.)
At exit 57B, take ramp right for I-395 North toward Washington (4.5 mi.)
At exit 4, take ramp right for Seminary Rd West toward Inova Alexandria Hospital / Northern Virginia Community College (0.6 mi.)
Turn left onto Mark Center Drive (0.1 mi.)
Turn right onto road (0.1 mi.)
Arrive on the left (0.0 mi.)
Distance from Hotel: 30.4 mi.
Travel Time: 36 min.

FROM REAGAN NATIONAL AIRPORT:
Depart S Smith Blvd (0.1 mi.)
Keep right onto road (0.6 mi.)
Take ramp right and follow signs for George Washington Memorial Pky North (1.2 mi.)
Take ramp right for I-395 South toward Richmond (5.0 mi.)
At exit 4, take ramp right for Seminary Rd West toward Inova Alexandria Hospital / Northern Virginia Community College (0.6 mi.)
Turn left onto Mark Center Dr (0.1 mi.)
Turn right onto road (0.1 mi.)
Arrive on the left (0.0 mi.)
Distance from Hotel: 7.6 mi.
Travel Time: 12 min.

FROM BWI:
Depart Friendship Rd (0.0 mi.)
Keep right toward Friendship Rd (0.2 mi.)
Bear right onto Friendship Rd (0.6 mi.)
Road name changes to I-195 W (1.8 mi.)
At exit 2B, take ramp right for MD-295 South toward Washington (24.9 mi.)
Road name changes to DC-295 S (4.0 mi.)
At exit 1B-C, take ramp right for I-695 toward Downtown (2.2 mi.)
Keep straight onto I-395 S (6.6 mi.)
At exit 4, take ramp right for Seminary Rd West toward Inova Alexandria Hospital / Northern Virginia Community College (0.6 mi.)
Turn left onto Mark Center Dr (0.1 mi.)
Turn right onto road (0.1 mi.)
Arrive on the left (0.0 mi.)
Distance from Hotel: 41.1 mi.
Travel Time: 49 min.

HILTON ALEXANDRIA MARK CENTER
5000 Seminary Road
Alexandria, VA 22311

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NOTES