PHILIPPINE CALIFORNIA ADVANCED RESEARCH INSTITUTE (PCARI)

Susan Pancho-Festin

Resilient Cyber Physical Societal Scale Systems

PCARI IIID 2013-54

Michael Angelo Pedrasa

Resilient Electricity Grids

PCARI IIID 2015-10

University of the Philippines

PHILIPPINE CALIFORNIA ADVANCED RESEARCH INSTITUTE (PCARI)

- Commission on Higher Education (CHED)
  - 2012 Joint Agreement between PH and US government for Philippine California Advanced Research Institutes (PCARI)
  - Initially budgeted in 2013 and 2014 of PH GAA (P1.763 B annually, now approximately USD$35M/year);
- Two virtual institutes:
  - Institute for Information Infrastructure Development (IIID)
  - Institute for Health Innovation and Translational Medicine (IHITM)
- Initial UC partners: UC Berkeley and UCSF, now expanded to other UCs
- USAID STRIDE

Resilient Electricity Grids

PCARI IIID-2015-10

FORCES All Hands Meeting
UC Berkeley
25 October 2017

Michael Angelo A. Pedrasa, PhD
Allan C. Nerves, PhD
Jordan Rel C. Orillaza, PhD
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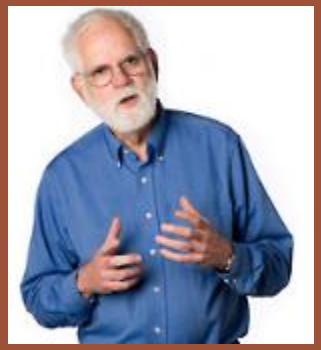

Carl Blumstein
Principal Investigator

Michael Angelo Pedrasa
Program Leader

Project 3: Resilient Electricity Grids through Data Analytics for Diagnostics and Intervention

Allan Nerves
Project Leader

Claire Tomlin
Co-Principal Investigator

Project 1: Resilient Demand Side Management Using Interruptible Loads

Jordan Orillaza
Project Leader

Alexandra von Meier
Co-Principal Investigator

Project 2: Micro-Synchrophasors for Resilient Distribution Network Operation and Control

Collaboration Activities: Joint Research

Resilient Energy Allocation Model for Supply Shortage Outages

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Abstract—Supply Shortage Outag
ring peak demand for developing
es, commercial loads have unuse
to 3000 MW, at the same time
ch as 700 MW during peak dema
entive to implement Demand Respo
s shortage. But when considering
deling perspective, social welfare th
jor objective for program impleme
case during an emergency situatio
between grid resilience and cost
The question is how the Distrib
timally allocate the unused genera
en this trade-off exists. We form
jective optimal dispatch model wh
nparison between the least-cost an

Optimal PMU Placement for Distribution Networks

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Abstract—This paper presents the optimal phasor measurement (PMU) placement for distribution networks. The optimal PMU placement (OPP) formulation from related literatures is presented in integer linear programming (ILP) framework where zero injection buses (ZIBs), PMU channel limitation, PMU outages and line outages were considered. Existing methods for OPP search space reduction (OPPSSR) such as the predetermined buses, ZIBs and leaf buses are also presented. To further reduce the search space for OPP, a method network reduction and deterministic PMU placement were proposed in dealing with non-branching bus series (NBS) that may be present in radial systems such as large distribution networks. Results have shown that the proposed OPPSSR methods was able to give the same optimal solutions with reduced amount of optimization.

Random Forest-based Fault Classification in Distribution Systems Using Phasor Measurements

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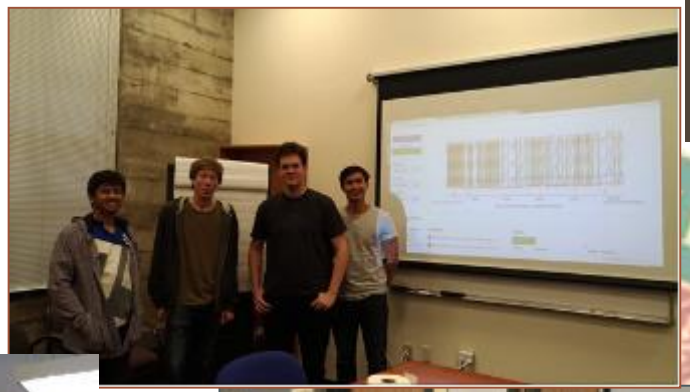
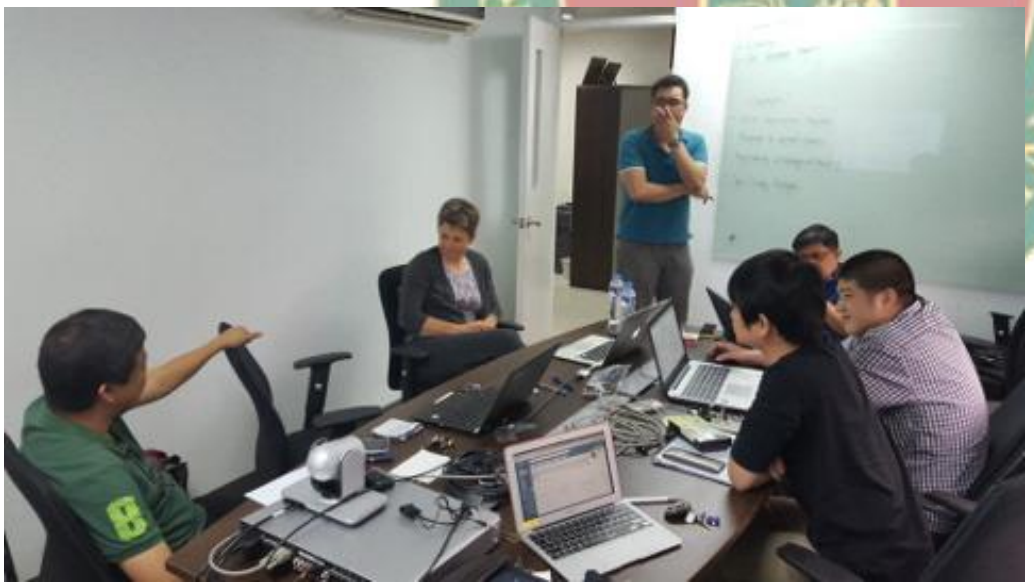
Collaboration Activities: Mentoring



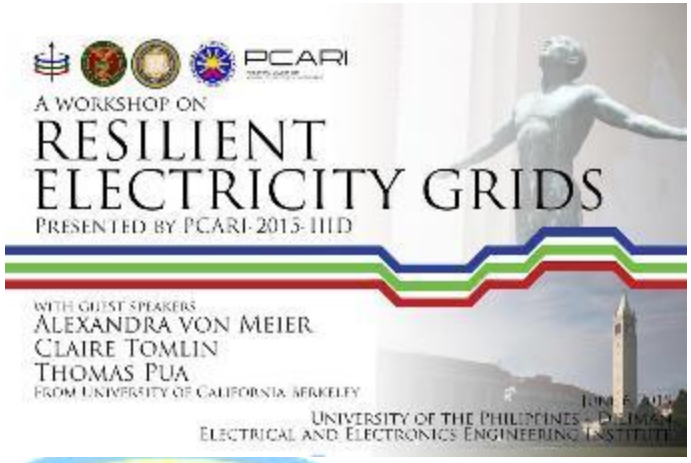
Collaboration Activities: Trainings

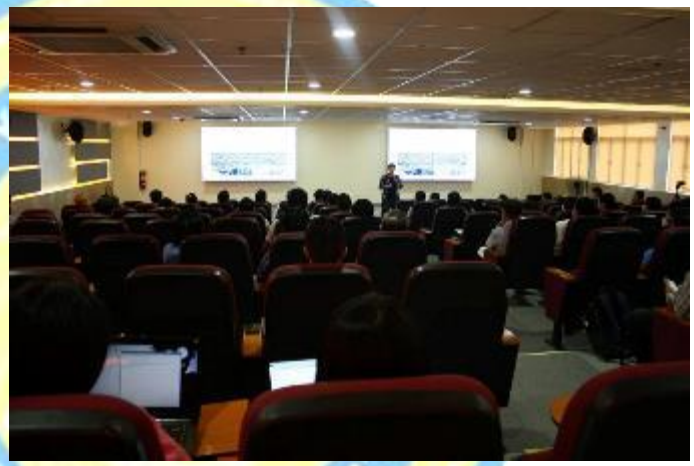
Collaboration Activities: Course Development

- Two courses on resilient electricity grids are currently being developed
  - Course 1: distribution network instrumentation + energy analytics
    - Lead by Sascha von Meier
  - Course 2: demand side management + energy analytics
    - Theoretical foundations for resilient electricity grids
    - Lead by Claire Tomlin



Collaboration Activities: Outreach





Resilient Electricity Grids

RESILIENT CYBER PHYSICAL SOCIETAL SCALE SYSTEMS

EDUCATION

- Offered courses on CPS, initially at the graduate level;
- Last semester offered first related undergraduate CS elective course: principles for design and analysis of computational elements that interact with physical environment
- Strengthen and expand current CS and EE offerings on computer/cyber security electives: adopt UCB and USC ISI DETER Testbed for security courses
- Strengthen and expand current CS and EE offerings on machine learning and AI, networking, OS, etc

ENERGY EFFICIENCY USING RETROFITTED SENSORS

- UC Berkeley BRITE work
- Extensive ACU need in the Philippines; average temperature (26.6 C / 79.9 F)
- Controlling ACUs using room temperature, occupancy, thermal comfort; inexpensive, retrofitted sensors, existing ACUs
- Consider resilience of sensors
- Instrumented three rooms in UP with sensors
- Linked with SinBerBEST (Prof. Spanos)

RESILIENT SENSOR PLACEMENT

WDN for an area in Metro Manila: 247.18 km length, ~2,400 pipes, 1,765 sensors

- FORCES' work on sensor placement and resilience for water distribution networks
- Initial work for a water utility company in Metropolitan Manila for resilient sensor placement, considering flood and earthquake hazard maps
- Nine areas in Metro Manila under the study

MICRO-GRID DEMAND SIDE MANAGEMENT AND RESPONSE

- FORCES' use of game theoretic models in analysis of strategies in various CPS domains: model consumer demand and behavior for a demand response scheme via an extended minority game model
- Challenge getting data: generating synthetic electricity load profiles of Philippine households using machine learning
- Design template for resilient microgrids, from storage, generation dispatch in multi-grid systems, techno-economic assessment of microgrid w/ renewable and component uncertainties
- Linked with Berkeley Labs Micro-grid group: DER-CAM (Distributed Energy Resources Energy Adoption Model)
- Setup microgrid testbed at UP

THANK YOU.

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