Physics-based Simulation for Robotic Manipulation

NRI: FND: Physics-based training of robots for manipulation of ropes and clothes
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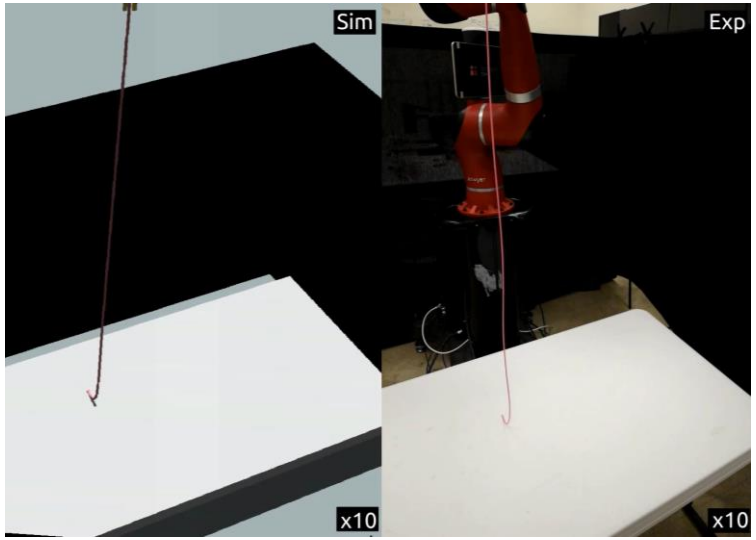
Challenge

- Slender structures (rods, shells) undergo large deformation during robotic manipulation. A robot should be able to predict the deformation for successful manipulation.



Solution

- Physics-based simulations to train robots for robust policies, in lieu of purely data-driven approach.

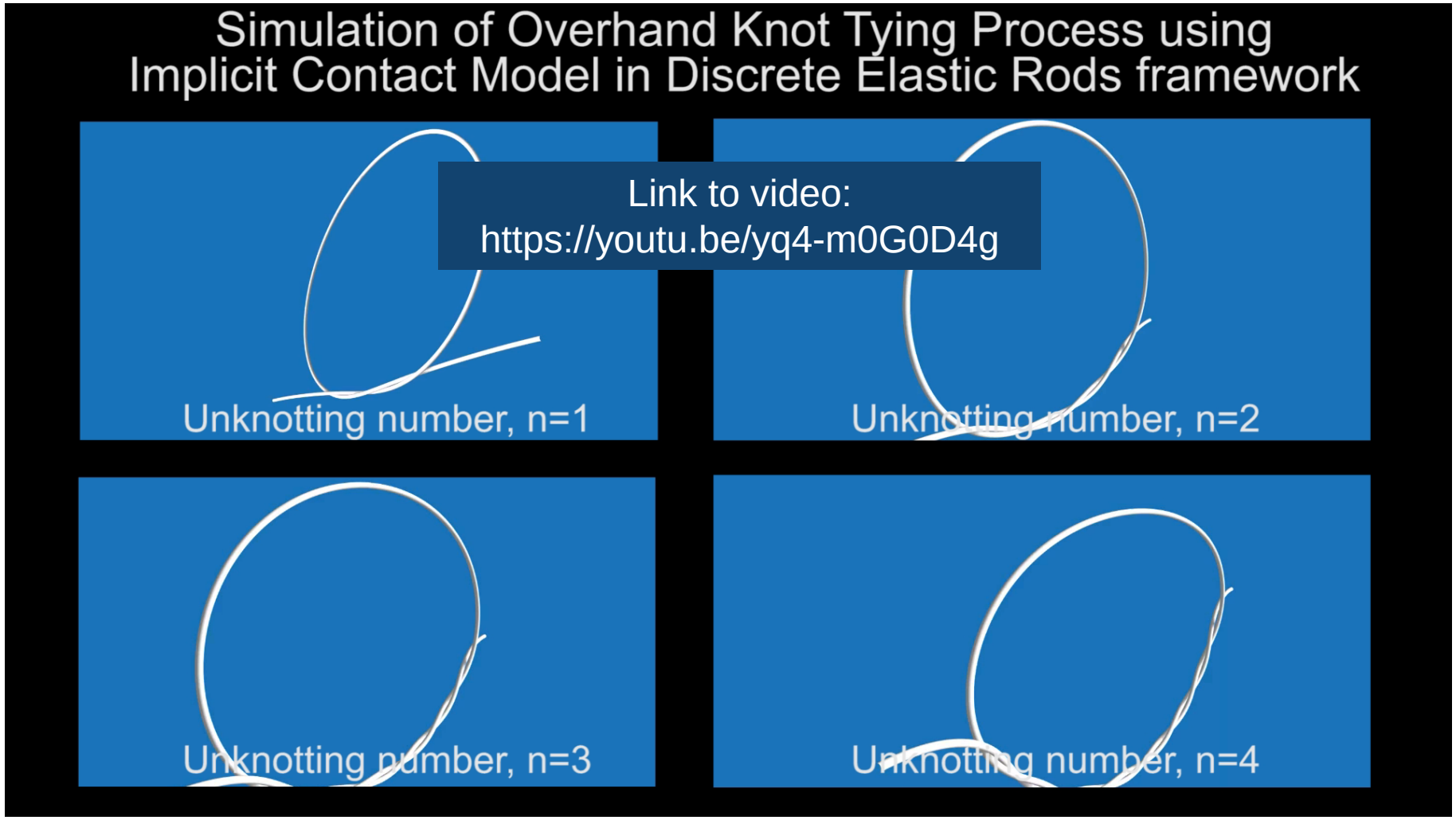
Scientific Impact

- Built-in robustness due to physics-based policies
- Transfer of simulations to reality

Broader Impact

- *Apps* (similar to smartphones) that can be downloaded onto the robot for manipulation tasks
- Learning from physics, instead of learning from human demonstration
- New course on mechanics and robotics https://structures.computer/education

Simulation of Elastic Rods with Frictional Contact



Project website:
http://structures.computer/roboticmanipulation

Choi, A., Tong, D., Jawed, M. K., & Joo, J. (2021). Implicit Contact Model for Discrete Elastic Rods in Knot Tying. *Journal of Applied Mechanics*, 1-13. doi.org/10.1115/1.4050238