

# Robotic Manipulation for Automated Stability Testing of Elastic Rods



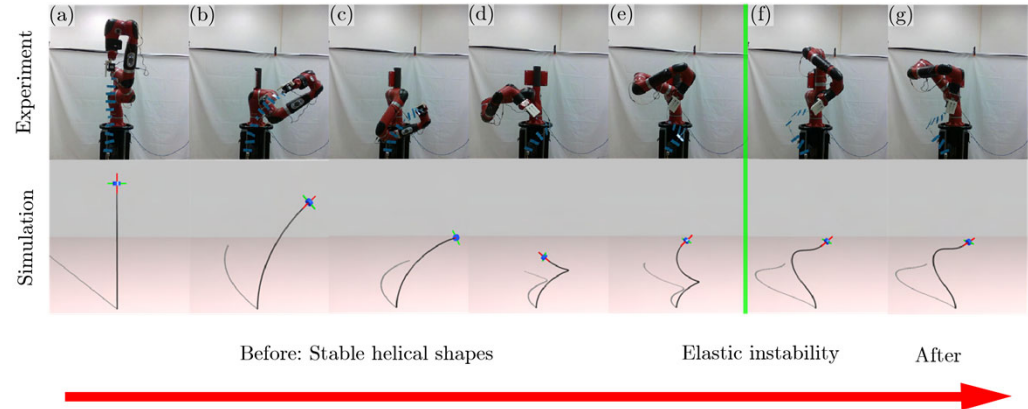
NRI: FND: Physics-based training of robots for manipulation of ropes and clothes

Award # 1925360 --- Date 09/01/2019 --- Web: <https://structures.computer/roboticmanipulation>

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## Challenge

Experimental analysis of the mechanics of a deformable object, and particularly its stability, requires repetitive testing and, depending on the complexity of the object's shape, a testing setup that can manipulate many degrees of freedom at the object's boundary



## Solution

Collaborative robots are employed for repetitive experimental trials on elastic rods

## Scientific Impact

- Introduction of robotics to the field of experimental mechanics
- Systematic experimentation on stability of deformable structures that sheds light on fundamental mechanics

## Broader Impact

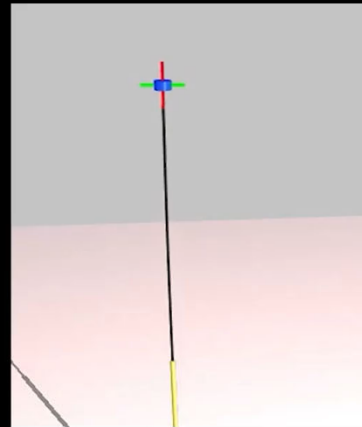
New course on mechanics and robotics  
<https://structures.computer/slenderstructures>

2022 NRI & FRR Principal Investigators' Meeting  
April 19-21, 2022

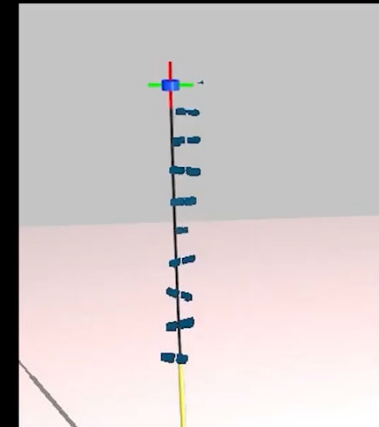
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Robotic Experiment



Discrete Elastic Rod Simulation



Comparison between Detected Markers and Simulated Rod

Project website:

<http://structures.computer/roboticmanipulation>

Link to Video:

<https://youtu.be/O48iDEIWY-8>

Reference:

Tong, D., Borum, A., and Jawed, M.K., 2021. Automated stability testing of elastic rods with helical centerlines using a robotic system. *IEEE Robotics and Automation Letters*, 7(2), pp.1126-1133. doi.org/10.1109/LRA.2021.3138532

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