

# 2022 ICRA Tutorial on Koopman Operator and Lifting Linearization: Emerging Theory and Applications of Exact Global Linearization of Nonlinear Robotic Systems

**When:** Friday, May 27, 2022, 8:30 am – 12:30 pm

**Where:** Room 113 B, PA Convention Center, Philadelphia

**What:** Half day tutorial by Harry Asada, MIT

**Tutorial URL:** <http://darbelofflab.mit.edu/2022-icra-tutorial/>

Koopman Operator theory for lifting linearization is an emerging new methodology being applied to broad robotics and related fields, ranging from dynamic modeling of complex systems, like soft robots and legged robots, to model predictive control, active learning, computer vision, and human-robot interactions. The Koopman Operator allows us to represent complex nonlinear systems with linear dynamic equations in a lifted space. It is not a type of pointwise linearization but is an exact linear model that is valid globally.

This tutorial will demystify the Koopman Operator theory. The materials will be presented in a way that is intuitive and easy to follow. You will gain valuable insights, learn fundamentals and algorithms, and find exciting applications and future directions in 3+ hours.

## Program

May 27, 2022

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| L1: 8:30 – 9:00.   | Introduction and Just-in-Time Math Review                          |
| L2: 9:00 – 9:45.   | Demystifying Koopman Operator Theory                               |
| L3: 9:45 – 10:10.  | DMD and Computational Algorithms                                   |
| Coffee Break       |  |
| L4: 10:40 – 11:25. | Control: modeling for control, MPC, and applications               |
| L5: 11:25 – 12:00. | Advanced Topics: Causality, Learning of observables, Physical laws |
| L6: 12:00 – 12:30. | Discussion and Future Directions                                   |