

About the Peter Sagirow Distinguished Seminar Series

Each year, the Institute for Systems Theory and Automatic Control (IST) brings an outstanding researcher to campus to report on the state of the art, achievements and challenges in the field of systems and control. With this distinguished seminar series, the IST intends to honor the late Peter Sagirow for his decisive role in developing the field of engineering cybernetics at the University of Stuttgart.

Control Theory and Collective Intelligence



Prof. Naomi Ehrich Leonard

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Abstract

A wide range of animals live and move in groups. Many animals do better in groups than alone when, for example, foraging for food, migrating, and avoiding predators. A key to group success is social interaction. Less well understood is how a group, with no centralized control, is capable of the fast and flexible decision-making required to carry out its tasks in an environment with uncertainty, variability, and dynamic change.

I will discuss the fundamental importance of control theory in uncovering the mechanisms of group decision-making and collective intelligence. Of central importance is the role of feedback and nonlinearity in fast and flexible decision-making: how indecision can be broken as fast as it becomes costly, and how sensitivity to stimulus can be tuned as context and environment change. I will discuss the significance and promise for the study and design of collective intelligence in nature and technology.

About the Speaker

Naomi Ehrich Leonard is Chair and Edwin S. Wilsey Professor of Mechanical and Aerospace Engineering at Princeton University. She is associated faculty with the Program in Applied and Computational Mathematics and the Biophysics Graduate Program, and affiliated faculty with the Princeton Neuroscience Institute. She is Founding Director of CreativeX, a Princeton engineering-and-the-arts collective, and Founding Editor of *Annual Review of Control, Robotics, and Autonomous Systems*. Leonard received her B.S.E. in Mechanical Engineering from Princeton University and her Ph.D. in Electrical Engineering from the University of Maryland. She is a MacArthur Fellow, a member of the American Academy of Arts and Sciences, and a Fellow of the ASME, IEEE, IFAC, and SIAM. Recent awards include the 2023 IEEE Control Systems Award and the 2024 Richard E. Bellman Control Heritage Award.

Leonard's background includes feedback control theory, nonlinear dynamics, geometric mechanics, and robotics, where she has contributed to theory and application. She studies and designs complex, dynamical systems comprised of many interacting agents, such as animals, humans, and autonomous vehicles, that move, sense, and decide together. She develops analytically tractable mathematical models of collective dynamics that provide the systematic means to examine the role of feedback, interconnection, and individual differences in the behavior, learning, and resilience of groups in changing environments. Leonard's collaborators have included researchers in oceanography, ecology, evolutionary biology, neuroscience, and political science, and artists.

**Thursday
Dec. 12, 2024
2 p.m.**

Lecture Room:
V 9.01

**Universität Stuttgart
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