Saurabh Amin to be chief scientist on multi-institutional NSF grant

Massachusetts Institute of Technology
Assistant Professor Saurabh Amin of the Department of Civil and Environmental Engineering is the chief scientist and lead MIT principal investigator on a multi-institutional grant announced last week [1] by the National Science Foundation (NSF). The grant is one of two awards totaling $14 million for research projects that are expected to make significant advances in energy and transportation infrastructures and health technology.

The MIT team — Amin, Associate Professor Hamsa Balakrishnan of the Department of Aeronautics and Astronautics and Professor Asuman Ozdaglar of the Department of Electrical Engineering and Computer Science — will work with the University of California at Berkeley (UC Berkeley), Vanderbilt University and the University of Michigan on the $9-million project, called Foundations of Resilient Cyber-Physical Systems (CPS). The goal of the project is to improve the operational resilience of civil and environmental structures and systems that have electronic networking components. Professor Shankar Sastry, dean of the College of Engineering at UC Berkeley is lead principal investigator on the grant.

“This investment in fundamental advances at the intersection of cyber and physical systems will pay huge dividends for our nation,” said Farnam Jahanian, NSF’s assistant director for Computer and Information Science and Engineering. “Advances in CPS hold the potential to reshape our world with more responsive, precise and efficient systems that augment human capabilities, work in dangerous or inaccessible environments, provide large-scale, distributed coordination and enhance societal well-being.”

The cyber component — sensors, actuators and communication networks — of large-scale infrastructures (electricity networks, water systems, ground and air transportation systems, etc.), is enabling new functionalities such as real-time monitoring and control. This connectivity provides technological means for improving the efficiency of infrastructure operations.

Yet infrastructure systems are not resilient; they remain vulnerable to failures from natural events and malicious attacks. The implementation of efficiency and strategies to improve resilience is dependent on human behavior, and the entities that manage and operate elements of these networked systems need incentives to invest in improvements.

This is the MIT team’s focus: developing methods for coupling technologies for monitoring and controlling networked systems with economic incentives for persuading operators to do so.

“A unique aspect of this project is that it aims to integrate the areas of control- and

incentive-based strategies for improving resilience and security to faults and attacks in large networked cyber-physical systems that involve human users and management decision-makers," Amin said.

The MIT team has expertise in both the physical and cyber aspects of transportation networks, electricity and water infrastructure networks, and are using tools from control theory, network economics and game theory to model the effect of human decision makers on the interface of controls and incentives, and design mechanisms to improve infrastructure resilience.

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