Title	*A Fundamental Look at Models and Intelligence*
Speaker	**Prof. Edward A. Lee** University of California, Berkeley, USA

Abstract

Models are central to building confidence in complex software systems. Type systems, interface theories, formal semantics, concurrent models of computation, component models, and ontologies all augment classical software engineering techniques such as object-oriented design to catch errors and to make software more modular and composable. Every model lives within a modeling framework, ideally giving semantics to the model, and many modeling frameworks have been developed that enable rigorous analysis and proof of properties. But every such modeling framework is an imperfect mirror of reality. A computer system operating in the physical world may or may not accurately reflect behaviors predicted by a model, and the model may not reflect behaviors that are critical to correct operation of the software. Software in a cyber-physical system, for example, has timing properties that are rarely represented in formal models. As artificial intelligence gets more widely used, the problem gets worse, with predictability and explainability seemingly evaporating. In this talk, I will examine the limitations in the use of models. I will show that two very different classes of models are used in practice, classes that I call "scientific models" and "engineering models." These two classes have complementary properties, and many misuses of models stem from confusion about which class is being used. Scientific models of intelligent systems are very different from engineering models.

Biography

Prof. Edward A. Lee Lee is the Robert S. Pepper Distinguished Professor of the Graduate School in Electrical Engineering and Computer Science at UC Berkeley, where he has been on the faculty since 1986. He is the author of Plato and the Nerd - The Creative Partnership of Humans and Technology (MIT Press, Fall 2017), Introduction to Embedded Systems - A Cyber-Physical Systems Approach (MIT Press, 2017), a number of other textbooks and research monographs, and more than 300 papers and technical reports. Lee has delivered more than 180 keynote talks and other invited talks at venues worldwide and has graduated at least 35 PhD students. Professor Lee's research group studies cyber-physical systems, which integrate physical dynamics with software and networks. His focus is on the use of deterministic models as a central part of the engineering toolkit for such systems. He has led the development of several influential open-source software packages, notably Ptolemy and its various spinoffs.

Lee is the director of iCyPhy, the Berkeley Industrial Cyber-Physical Systems Research Center, and the Ptolemy project. From 2013-2017, he was director of the nine-university TerraSwarm Research Center. From 2005-2008, he served as chair of the EE Division and then chair of the EECS Department at UC Berkeley. He received his BS degree in 1979 from Yale University, with a double major in Computer Science and Engineering and Applied Science, an SM degree in EECS from MIT in 1981, and a PhD in EECS from UC Berkeley in 1986. From 1979 to 1982 he was a member of technical staff at Bell Labs in Holmdel, New Jersey, in the Advanced Data Communications Laboratory. He is a co-founder of BDTI, Inc., where he is currently a Senior Technical Advisor, and has consulted for a number of other companies.

Lee is a Fellow of the IEEE, was an NSF Presidential Young Investigator, won the 1997 Frederick Emmons Terman Award for Engineering Education, and received the 2016 Outstanding Technical Achievement and Leadership Award from the IEEE Technical Committee on Real-Time Systems (TCRTS).