# Keynote
## Model Checking Hybrid Systems

Edmund M. Clarke
(Joint work with Sicun Gao and Soonho Kong)
Carnegie Mellon University
Pittsburgh, USA

**Abstract:** Although every undergraduate in computer science learns about Turing Machines, it is not well known that they were originally proposed as a means of characterizing computable real numbers. For a long time, formal verification paid little attention to computational applications that involve the manipulation of continuous quantities, even though such applications are ubiquitous. In recent years, however, there has been great interest in safety-critical hybrid systems involving both discrete and continuous behaviors, including autonomous automotive and aerospace applications, medical devices of various sorts, control programs for electric power plants, etc. As a result, the formal analysis of numerical computation can no longer be ignored. In this talk, we focus on one of the most successful verification techniques, bounded model checking. Current industrial model checkers do not scale to handle realistic hybrid systems. We believe that the key to handling more complex systems is to make better use of the theory of the computable reals and computable analysis. We argue that new formal methods for hybrid systems should combine existing discrete methods in model checking with new algorithms based on computable analysis. In particular, we discuss a model checker that we are currently developing along these lines.

### About the Speaker

**Edmund M. Clarke** is the FORE Systems University Professor of Computer Science at Carnegie Mellon University. He received his Ph.D. from Cornell University and taught at Duke and Harvard Universities before joining CMU in 1982. His research interests include hardware and software verification and automatic theorem proving. In particular, his research group developed Symbolic Model Checking using BDDs, Bounded Model Checking using fast CNF satisfiability solvers, and pioneered the use of CounterExample-Guided-Abstraction-Refinement (CEGAR). He is a co-founder of the conference on Computer Aided Verification (CAV). He has received numerous awards for his contributions to formal verification of hardware and software correctness, including the IEEE Goode Award, the ACM Kanellakis Award , the ACM Turing Award, and the CADE Herbrand Award. Dr. Clarke is a member of the National Academy of Engineering and the American Academy of Arts and Sciences. Most recently he received the 2014 Franklin Institute Bower Award and Prize for Achievement in Science for verification of computer systems.