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KEYNOTE ON "THE PROPAGATION APPROACH FOR COMPUTING BIOCHEMICAL REACTION NETWORKS"

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ABSTRACT

Joint work with Maria Mateescu.

Propagation models provide a framework for describing algorithms for the transient analysis of stochastic state transition systems, such as computing event probabilities, expectancies, and variances on biochemical reaction networks. We discuss the syntax, semantics, and pragmatics of propagation models. We give three use cases for propagation models: the chemical master equation, the reaction rate equation, and a hybrid method that combines these two equations. We present a propagation abstract data type (ADT) for implementing uniformization and integration algorithms on propagation models. The propagation ADT is based on an update operator, which propagates continuous mass values through a discrete state space. The update operator can be implemented using a threshold abstraction, which propagates only "significant" mass values and thus achieves a controllable compromise between efficiency and accuracy.

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Thomas A. Henzinger is President of IST Austria in Klosterneuburg, Austria. He holds a Dipl.-Ing. degree in Computer Science from Kepler University in Linz, Austria, an M.S. degree in Computer and Information Sciences from the University of Delaware, and a Ph.D. degree in Computer Science from Stanford University (1991). He was Assistant Professor of Computer Science at Cornell University (1992-95), Assistant Professor (1996-97), Associate Professor (1997-98), and Professor (1998-2004) of Electrical Engineering and Computer Sciences at the University of California, Berkeley, and Professor of Computer and Communication Sciences at EPFL in Lausanne, Switzerland(2004-09). He was also Director at the Max-Planck Institute for Computer Science in Saarbruecken, Germany (1999). His research focuses on modern systems theory, especially models, algorithms, and tools for the design and verification of reliable software, hardware, and embedded systems. His HyTech tool was the first model checker for mixed discrete-continuous systems. He is an ISI highly cited researcher, a member of Academia Europaea, a member of the German Academy of Sciences (Leopoldina), a member of the Austrian Academy of Sciences, a Fellow of the ACM, and a Fellow of the IEEE.

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