

---

# SCS Keynote Speaker

---



**TITLE:**

How Theory and Abstraction Drive Progress in Simulation Science and Practice

**AUTHOR:**

Bernard P. Zeigler, RTSync Corp., USA

**ABSTRACT:**

The notions of state and discrete event were allied abstractions conceived to characterize models underlying the operations research techniques that emerged in the mid-1950s. At that time the limitations of queueing analysis methods for supporting industrial design became evident and led to new abstractions, first spurring machine language attempts to handle specific complex systems, then eventually to general purpose simulation modeling tools. Innovator K.D. Tocher's core idea was that of a system of individual components progressing through 'states' that change only at discrete 'events' as time unfolds. Later, the Discrete Event Systems Specification (DEVS) formalism took the discrete event abstraction one step further using the set theory of logicians and mathematicians. This talk starts with the proposition that both abstraction and its concrete realization are essential for progress – abstractions enable uncluttered thought while concrete realizations are closer to reality but necessarily messy. Our theme riffs on the progression: new abstractions lead to new model representations which in turn drive requirements for new computational environments to exercise and explore these models. When the new abstractions can be related to existing ones, the process of integrating new models and extending legacy simulation systems can be smoother encountering less resistance to change. To make these points we recount some history of DEVS and its progress from a research abstraction to industrial strength realizations supported by high-performance simulation technology. We indicate how progress continues with deeper theory and new abstractions that can enable modeling complex systems of systems from neuron networks to aviation and cyber-systems

**SHORT BIO:**

Bernard P. Zeigler is Professor Emeritus of Electrical and Computer Engineering at the University of Arizona. While in Arizona, Dr. Zeigler served as the Co-Director of the Arizona Center for Integrative Modeling and Simulation (ACIMS). He is currently Chief Scientist with RTSync Corp. an ACIMS spin-off dedicated to commercialization of ACIMS technology. and affiliated with the Center of Excellence in Command, Control, Communications, Computing and Cyber. Zeigler is best known for his highly cited publication, "Theory of Modeling and Simulation" and has received much recognition for his various scholarly publications, achievements, and professional service. His 1984 book, "Multifaceted Modelling and Discrete Event Simulation," received the Outstanding Publication Award in 1988 from The Institute of Management Sciences (TIMS) College on Simulation. Zeigler was made Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for his invention of the Discrete Event System Specification (DEVS) formalism in 1995. He is also Fellow of The Society for Modeling and Simulation International (SCS) where he served as President (2002-2004) as well as in other positions. He is a member of the SCS

Hall of Fame and received Lifetime Achievement Awards from both the SCS and the INFORMS Simulation Society.