

**System Dynamics:  
Applied to Modeling the Dynamics of Software Project Management and State Stability**

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**ABSTRACT**

Many approaches to analyzing complex situations are based on “driving forward by looking through the rear-view mirror.” That is, they rely almost exclusively upon the use of past data to predict the future. Although this sometimes is helpful, they frequently can lead to very wrong predictions, especially when the actual outcome is counter-intuitive, and, furthermore, they often provide little insight and understanding of the reasoning.

In contrast, the **System Dynamics** (SD) approach is based on identifying individual causalities and how they combine to create, often non-linear, feedback loops that are the causes of the counter-intuitive outcomes. This approach can greatly leverage the deep, but often isolated and fragmented, knowledge from Subject Matter Experts to provide much better insights and understanding. The core of the SD modeling strategy is representation of system structure in terms of stocks, flows, and the causal mechanisms that govern their rates of change. In this connection, feedback loops are the building blocks for articulating the causality represented in these models. The interaction among the various feedback loops in a model can represent and explain system behavior.

SD models explicitly recognizes the complex interactions among many feedback loops, rejects notions of linear unidirectional cause-and-effect, and allows the analyst to view a complete system of relationships whereby the ‘cause’ might also be affected by the ‘effect’. SD enables analysts to uncover ‘hidden’ dynamics. It also allows for understanding the long term effects of short term policies or behaviors.

In this talk, the SD approach will be illustrated through its use in two projects focused on:

- The dynamics of software project management
- State stability, especially as impacted by insurgents and terrorist networks

**REFERENCES**

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## **BIOGRAPHY OF SPEAKER**

Professor Stuart Madnick has been a faculty member at M.I.T. since 1972. He has served as the head of MIT's Information Technologies Group for more than twenty years. During that time the group has been consistently rated #1 in the nation among business school information technology programs (*U.S. News & World Reports*, *BusinessWeek*, and *ComputerWorld*). He has also been an affiliate member of MIT's Laboratory for Computer Science, a member of the research advisory committee of the International Financial Services Research Center, and a member of the executive committee of the Center for Information Systems Research.

Dr. Madnick is a prolific writer and is the author or co-author of over 250 books, articles, or reports including the classic textbook, *Operating Systems* (McGraw-Hill), and the book, *The Dynamics of Software Development* (Prentice-Hall). He has also contributed chapters to other books, such as *Information Technology in Action* (Prentice-Hall).

His current research interests include connectivity among disparate distributed information systems, database technology, software project management, and the strategic use of information technology. He is presently co-Director of the PROductivity From Information Technology (PROFIT) Initiative and co-Heads the Total Data Quality Management (TDQM) research program.

He has been the Principal Investigator of a large-scale DARPA-funded research effort on Context Interchange which involves the development of technology that helps organizations to work more cooperatively, coordinated, and collaboratively. As part of this effort, he is the co-inventor on the patents "Querying Heterogeneous Data Sources over a Network Using Context Interchange" and "Data Extraction from World Wide Web Pages."

He has been active in industry, making significant contributions as a key designer and developer of projects such as IBM's VM/370 operating system and Lockheed's DIALOG information retrieval system. He has served as a consultant to many major corporations, such as IBM, AT&T, and Citicorp. He has also been the founder or co-founder of several high-tech firms, including Intercomp (acquired by Logicon), Mitrol (acquired by General Electric's Information Systems Company), Cambridge Institute for Information Systems (subsequently re-named Cambridge Technology Group), iAggregate (acquired by ArsDigita which was subsequently acquired by Red Hat), and currently operates a hotel in the 14th century Langley Castle in England.

Dr. Madnick has degrees in Electrical Engineering (B.S. and M.S.), Management (M.S.), and Computer Science (Ph.D.) from MIT. He has been a Visiting Professor at Harvard University, Nanyang Technological University (Singapore), University of Newcastle (England), Technion (Israel), and Victoria University (New Zealand).