

# Editorial Introduction

**Bernard P. Zeigler, Ph.D.**  
Editor-in-Chief

This issue brings together three different, though related, perspectives on theory-based methodologies and techniques that are beginning to infuse into the world of defense modeling and simulation. An enumeration of such concepts is given in the first article, "Creating Spatially-Shaped Defense Models Using DEVS and Cell-DEVS," by Wainer and Madhoun. The list includes such ideas as agent-based modeling, hierarchical/modular model construction, model abstraction, separation of model and simulator levels, automatic model verification, experimental frame specifications, dynamic or variable structure, and multi-formalism modeling. Wainer and Madhoun show that, when implemented and made usable in simulation environments, these concepts provide greater power to describe, build, test, and apply models capable of addressing real-world complexities.

Nevertheless, workable approaches to some key issues in the M&S methodology remain elusive. One of which, how to acquire knowledge underlying military tactics to inform computer generated forces for training simulations, is addressed in the paper "Automating the Acquisition of Tactical Knowledge for Military Missions," by Gonzalez, Castro, and Gerber.

These authors show how hierarchical/modular model construction in the form of a context-based reasoning paradigm can greatly facilitate the knowledge acquisition process for tactical behaviors.

A second challenge has been recognized for some time but has resisted non-theory-based solutions; that is to say, solutions that are based on advanced software technology alone. The problem here is how to compose and interoperate disparate legacy simulations that might be needed to address a new simulation requirement. In their article, "Toward a Meta-Level Framework for Agent-Supported Interoperation of Defense Simulations," Yilmaz and Paspuleti propose a framework that identifies a new layer of architecture in addition to those of models and simulators. The proposed layer employs agent-based modeling concepts to provide mediation, brokering, matchmaking, and facilitation services needed to ameliorate the composability and interoperability problems.

In this issue, we see that M&S theory is starting to take effect in defense applications. At the same time, as we learn more about the problems we face, we begin to see where theory will have to be pushed well beyond its current limits.