

APPLICATIONS OF INFORMATION SYSTEMS TO HOMELAND SECURITY AND DEFENSE



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Preface

This book introduces several new advances in security and defense. Unlike previous work, much of this relies on modern computational abilities to model scenarios in much more detail than has previously been possible. Key to much of this work is the principle of complex behavior emerging from local interaction of a large number of simple components. By this, it is possible to design a system of many small components with very simple interactions. The emphasis when modeling this system is placed on a system approach, where the components and their relationships are identified. By executing this system, extremely complex behavior can be generated.

In this respect, this approach differs from previous work that emphasized modeling of a problem in a top-down manner or by modeling the global behavior directly without considering the local interaction that contributes to this global behavior. For example, in the military sphere, the Lanchester equations represent a time-dependent abstract value for some attacker's and defender's strengths, where each of those strengths are modified dependent on their opponent's strength and some function. Equations of this type have the advantages that they are easy to simulate and easy to evaluate. However, they suffer from many disadvantages.

First, often it is difficult to modify these equations to incorporate more complex interactions; for example, to add in concepts of morale, ammunition, re-supply or terrain. Partly, this is due to the nature of the differential equation, which is exclusively limited to specifying the change of different components as a function over the different elements of the system of equations. Thus, as the model becomes more complex, describing the differential equation be-