

## Foreword

This special issue of *Chemical Engineering Science* is devoted to the development of a scientific perspective on complexity, and in particular as it applies to problems of interest to chemical engineers. In the course of its evolution, the field of chemical engineering has moved both up and down the scales of length and time. In the first half of the last century, the focus was on developing mathematical descriptions for individual units (e.g., heat exchangers, reactors, distillation columns) involved in chemical process. These efforts were based on the vision of fluids and solids as continuous media. As it became evident that the properties of continuous media could be described in terms of the properties of molecules, chemical engineers moved from the length scale of meters to that of nanometers. Similar efforts have been undertaken to understand the properties of solid materials, such as polymers and catalysts. More recently, there has been a growing recognition that complex patterns and phenomena can arise from the cooperative interactions of very large ensembles of systems, as exemplified by cloud formation, turbulence in fluids, and the evolution of one bacterial strain over another in

living systems. Similar phenomena are now being found in the interactions of large ensembles of systems, such as corporations and nations. Therefore, today it is not uncommon for chemical engineers to be interested in phenomena and processes spanning twelve orders of magnitude in the domains of length and time. The challenge is to understand what new patterns and structures emerge from a systematic examination of complex systems and to anticipate how these features can be used for beneficial purposes. The 26 papers appearing in this issue address various aspects of the challenge and offer interesting and potentially exciting opportunities for future research. The Board of Editors of CES is most appreciative of Jinghai Li and Wei Ge's efforts in assembling this collection of papers.

*Chairman, Board of Editors*

Alexis T. Bell

*Department of Chemical Engineering*

*University of California,*

*Berkeley, CA 94720-1462, USA*

*E-mail address: [bell@cchem.berkeley.edu](mailto:bell@cchem.berkeley.edu)*