Engineering of Chemical Complexity II (World Scientific Lecture Notes in Complex Systems)

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This second review volume is a follow-up to the book “Engineering of Chemical Complexity” that appeared in 2013. Co-edited by the Nobel laureate Gerhard Ertl, this book provides a broad perspective over the current research aimed at understanding, the design and control of complex chemical systems of various origins, on the scales ranging from single molecules and nano-phenomena to macroscopic chemical reactors. Self-organization behavior and emergence of coherent collective dynamics in reaction–diffusion systems, in active soft matter and biochemical networks are discussed. Special attention is paid to applications in cell biology, to molecular motors and microfluidics effects.

The reviews, prepared by leading international experts from the EU, USA, Russia and Japan, together yield a fascinating picture of a rapidly developing research discipline that brings chemical engineering to new frontiers.

Contents:

- From Simple to Complex Oscillatory Behavior in Cellular Regulatory Networks *(Albert Goldbeter and Claude Gérard)*
- Time Dependent Michaelis–Menten Equations for Open Enzyme Networks *(Jon Young, Dieter Armbruster and John Nagy)*
- Environmental Dependence of the Activity and Essentiality of Reactions in the Metabolism of Escherichia Coli *(Oriol Güell, M Ángeles Serrano and Francesc Sagués)*
- Chemically-Driven Biological Brownian Machine *(Mitsuhiro Iwaki)*
- Diffusiophoretic Nano and Microscale Propulsion and Communication *(Vinita Yadav, Wentao Duan and Ayusman Sen)*
- Phase-Field Description of Substrate-Based Motility of Eukaryotic Cells (Igor S Aranson, Jakob Löber and Falko Ziebert)
- From Colloid Thermophoresis to Thermophoretic Machines *(Marisol Ripoll and Mingcheng Yang)*
- Hydrodynamics Mediated Collective Motions in Populations of Microdroplets *(Shashi Thutupalli, Jean-Baptiste Fleury, Ulf Schiller, Gerhard Gompper, Stephan Herminghaus and Ralf Seemann)*
- Modeling Stimuli-Induced Reconfiguration and Directed Motion of Responsive Gels *(Debabrata Deb, Pratyush Dayal, Anna C Balazs and Olga Kuksenok)*
- Dissipative BZ Patterns in Systems of Coupled Nano- and Microdroplets *(Vladimir K Vanag and Irving R Epstein)*
- Control of Chemical Wave Propagation *(Jakob Löber, Rhoslyn Coles, Julien Siebert, Harald Engel and Eckehard Schöll)*
- Flow-Induced Control of Pattern Formation in Chemical Systems *(Igal Berenstein and Carsten Beta)*
- Dynamics of Filaments of Scroll Waves *(Vadim N Biktashev and Irina V Biktasheva)*
- Unusual Synchronization Phenomena during Electrodissolution of Silicon: The Role of Nonlinear Global Coupling *(Lennart Schmidt, Konrad Schönleber, Vladimir García-Morales and Katharina Krischer)*
- Optimal Control of Entrainment of Nonlinear Oscillators with Weak Feedback and Forcing *(Yifei Chen and István Z Kiss)*

Readership: Graduate students, research scientists and academics interested in the study of complex

chemical systems.

Key Features:

- Various aspects related to the engineering of complex chemical systems are systematically treated and a broad survey of both experimental and theoretical studies is given

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