

Contents

Part I. General Nonlinear Behavior

Phenomenes nonlineaires de la dynamique chimique: allocution d'ouverture
By P. Glansdorff 2

La Chimie à la croisée des disciplines traditionnelles. Comportements
identiques de populations différentes. By A. Pacault, F. Carmona
and J.J. Piau (With 7 Figures) 5

Dynamical Systems Described by Discrete Maps with Noise
By H. Haken and A. Wunderlin 15

Thermokinetic Oscillations and Multistability in Gas-Phase Oxidations
By P. Gray, J.F. Griffiths, and S.M. Hasko 20

Part II. Weak Turbulence

Chemical Kinetics and Differentiable Dynamical Systems
By D. Ruelle 30

Topology of Chaos in a Chemical Reaction
By J.C. Roux and H.L. Swinney (With 5 Figures) 38

Experiments on Chaos in a Continuous Stirred Reactor
By J.L. Hudson, J. Mankin, J. McCullough, and P. Lamba (With 9 Figures) 44

Chemical Kinetics as an Experimental Field for Studying the Onset of
Turbulence. By C. Vidal (With 7 Figures) 49

Transition vers la turbulence par intermittence. By Y. Pomeau 63

Bifurcation of *Motifs* in Families of *Mixed Two-Vector Fields*
By C. Lobry and R. Lozi (With 7 Figures) 67

Bifurcations élémentaires—successions et interactions
By G. Iooss (With 2 Figures) 71

Chaos and Chemistry. By O.E. Rössler 79

Evolution of Chaos and Power Spectra in One-Dimensional Maps
By H. Mori (With 6 Figures) 88

Tests of the Period-Doubling Route to Chaos. By M.J. Feigenbaum 95

Part III. Stochastic Analysis

Thermal Fluctuations in Nonlinear Chemical Systems By G. Nicolis, F. Baras, and M. Malek Mansour (With 2 Figures)	104
Fluctuations in Non-Equilibrium Phase Transitions: Critical Behavior By P. Hanusse	115
Critical Exponents of a Pure Noise Induced Transition, Nonlinear Noise and Its Effect on an Electrohydrodynamic Transition in Nematics By R. Lefever and W. Horsthemke	120

Part IV. Critical Phenomena

Critical Slowing Down of Chemical Reactions Near Thermodynamic Critical Points. By I. Procaccia	128
Metastability and Nucleation in Chemical Systems with Multiple Steady States. By J. Boissonade (With 4 Figures)	134

Part V. Coupling of Oscillators

Synchronization of a Chemical Oscillation by Periodic Light Pulses By E. Dulos (With 13 Figures)	140
Electrically Coupled Belousov-Zhabotinsky Oscillators: A Potential Chaos Generator. By M.F. Crowley and R.J. Field (With 6 Figures)	147

Part VI. Reaction-Diffusion Problems

The Rotor as a Phase Singularity of Reaction-Diffusion Problems and Its Possible Role in Sudden Cardiac Death. By A.T. Winfree (With 1 Figure)	156
Chemical Waves in the Iodate-Arsenous Acid System By A. Hanna, A. Saul, and K. Showalter (With 7 Figures)	160
Mécanisme réactionnel fondé sur une étude expérimentale expliquant des instabilités interfaciales liées à des réactions chimiques By E. Nakache and M. Dupeyrat (With 3 Figures)	166

Part VII. Biochemical Processes

Complex Dynamic Structures By B. Hess, E.M. Chance, A.R. Curtis, and A. Boiteux (With 2 Figures)	172
Two Topics in Chemical Instabilities: I. Periodic Precipitation Processes; II. Resonances in Oscillatory Reactions and Glycolysis By J. Ross	180

Part VIII. From Bistability to Oscillations

Bistability in a C.S.T.R.: New Experimental Examples and Mathematical Modeling. By I.R. Epstein, C.E. Dateo, P. De Kepper, K. Kustin, and M. Orbán (With 4 Figures)	188
Chlorite Oscillators: A Result of the Cross-Shaped Phase Diagram Technique By P. De Kepper (With 4 Figures)	192

A New Type of Chemical Oscillator: Potential Oscillation and Bistability on a Platinum Electrode in some Aqueous Hydrogen-Halogen (ATE) Pumped Systems. By M. Orbán and I.R. Epstein (With 2 Figures)	197
Constrained and Continuously Pumped Chemical Systems with Emphasis on Conditions for Bistability. By R.M. Noyes (With 1 Figure)	201
Perturbation of Bromate Oscillators By E. Körös, M. Varga, and G. Putirskaya (With 4 Figures)	207
Periodic Reactions with Bromate II: Verification of Selection Criteria of Organic Radicals Oscillating Without Catalysts By J. Chopin-Dumas and P. Richetti (With 3 Figures)	213
 <i>Part IX. Mathematical Modeling</i>	
On Scaling the Oregonator Equations By J.J. Tyson (With 3 Figures)	222
The Behaviour of a Multistable Chemical System Near the Critical Point By K. Bar-Eli (With 9 Figures)	228
Recent Developments in the Theory of Stoichiometric Networks and Application to the Belousov-Zhabotinsky System By B.L. Clarke (With 4 Figures)	240
 <i>Part X. Poster Abstracts</i>	
Stratification Phenomena in Corrosion Scales: Towards a Nonlinear Interpretation. By G. Bertrand, J.-M. Chaix, K. Jarraya, and J.-P. Larpin (With 2 Figures)	248
Nucleation Process in the Two-Dimensional X Schlögl Model By A. Blanché and P. Hanusse	250
From Bistability to Oscillations: A Phase Diagram Approach. Application to the Belousov-Zhabotinsky Reaction By J. Boissonade and P. De Kepper	251
Numerical Simulations of Surface Reactions By M. Bouillon, R. Dagonnier, P. Dufour, and M. Dumont	252
On the Preoscillatory Period of the Belousov-Zhabotinsky Reaction: A Search for Intermediates. By M. Burger and K. Rácz	253
Non-Equilibrium Phase Transition of the Intercalation Process By T. Butz, A. Hübler, and A. Lerf (With 1 Figure)	254
Pseudo-Steady States in Solid-Liquid Systems By M. Cournil, P. Galtier, and F. Conrad	255
A + 2B = 3B Kinetics Producing all or Flip or None Stimulus Response in a Cell Model, and Strategies for a Chemical Implementation of such Kinetics By P. Decker and O. Saygin (With 1 Figure)	256
Topological Order in 2D Chemical Systems By C. Dewel, D. Walgraef, and P. Borckmans	257
Bifurcation of Multiple Limit Cycles in Plane Quadratic Mass-Action Systems By C. Escher	258

Belousov-Zhabotinsky System: Mechanism of the Ce ^{IV} /Bromate Reaction By H.D. Försterling, H.J. Lamberz, and H. Schreiber	259
The Legitimacy of the Quasi-Steady State Approximation in Enzyme Kinetics: A Singular Perturbation Approach. By G. Fritzsche and M.S. Seshadri ...	260
Nonlinear Phenomena in Stirred Flow Systems of Mn ²⁺ and Acidic Bromate By W. Geiseler	261
On Phase Transitions in Schlögl's Second Model. By P. Grassberger	262
A Nonlinear Phenomenon of Chemical Dynamics in Geology: The Case of Skarns By B. Guy	263
The Prepattern Theory of Mitosis: Spatial Dissipative Structures in the 3-Dimensional Sphere. By A. Hunding	264
Mechanistic Study of the Briggs-Rauscher Reaction By P. De Kepper and I. Epstein (With 1 Figure)	265
Multiwavelength Analysis of Linear and Nonlinear Kinetics in the CSTR By H. Lachmann	266
Inhomogeneous Fluctuations and Bifurcations in Nonlinear Chemical Systems By H. Lemarchand and G. Nicolis	267
Temperature-Compensated Epigenetic Oscillations: Timing of Cell Division Cycles and Circadian Rhythms? By D. Lloyd and S.W. Edwards (With 1 Figure)	268
Chaotic Behavior of E.H.D. Instability for an Insulating Liquid Subjected to Unipolar Injection. By B. Malraison and P. Atten	269
Effect of Light Intensity Fluctuations on a Real Photochemical Reaction: The Thermoluminescence of Fluorescein in Boric Acid Glass By J.C. Micheau, W. Horsthemke and R. Lefever (With 1 Figure)	270
Bifurcation Theoretic Approach for Strong Field Photodissociation Phenomenon By N.K. Rahman	271
A Linear Method to Analyze a Nonlinear Oscillator: Driving the Glycolytic Oscillator by Sinusoidal Temperature Cycles By K.A. Rinast, R. Heringer, R. Joerres, T. Kreuels, W. Martin and K. Brinkmann	272
Bursting Phenomena in the Belousov-Zhabotinsky Reaction By J. Rinzel and W.C. Troy	273
Experimental Investigations and Model Simulations for Studying the Influence of Noise and External Disturbances on the Behavior of the Belousov- Zhabotinsky Reaction. By P.G. Sørensen (With 1 Figure)	274
Linearization Procedure and Nonlinear Systems of Differential and Difference Equations. By W.-H. Steeb	275
Reversible and Non-Reversible Modifications of Enzyme Systems Activity by Electric Field. By J.M. Valleton, E. Selegny, and J.C. Vincent	276
A Dynamic Regime with Structured Fourier Spectrum By C. Vidal and A. Rossi (With 1 Figure)	277
<i>Index of Contributors</i>	279

