Abstract for Dynamics Days Crete 2006

Topic: Other

The complex bifurcation scenario of the HPTCu reaction

D. Bakeš[1*], L. Schreiberová[1], I. Schreiber[1], M. J. B. Hauser[2]

[1] Department of Chemical Engineering and Center for Nonlinear Dynamics of Chemical and Biological Systems, Institute of Chemical Technology, Prague, Czech Republic

[2] Institut für Experimentelle Physik, Abteilung Biophysik, Otto-von-Guericke-Universität Magdeburg, Germany

[*] Electronic Address: daniel.bakes@vscht.cz

Complex oscillatory dynamics of the chemical reaction of hydrogen peroxide with thiosulphate catalyzed by cupric ions (HPTCu) is studied. The reaction is characterized by a significant variation of hydrogen ions concentration in time, therefore the system is a so-called pH oscillator. If the reaction takes place in an isothermal continuous flow stirred tank reactor, rich dynamical behavior is observed including oscillations, multistability and excitability. The oscillatory behavior is the main focus of this work. Results presented here show various temporal oscillatory patterns including simple oscillations, period two oscillations, chaotic oscillations, complex mixed-mode oscillations, frequency locking and quasiperiodicity. The dynamics are studied in dependence on flow rate. For different values of the flow rate, the pH time series are measured and one-parameter bifurcation diagram is constructed. Based on these results, the bifurcation scenarios are identified to involve a subcritical Hopf bifurcation, period-doubling bifurcation(s) and a bifurcation to two-torus. For aperiodic time series phase space reconstruction is performed, embedding dimension estimated and maximum Lyapunov exponent calculated. A positive value of this exponent indicates the presence of a chaotic attractor.