

M. J. B. Hauser, and L. F. Olsen:
Mixed-Mode Oscillations and Homoclinic Chaos in an Enzyme Reaction
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Abstract:

We have studied mixed-mode oscillations (MMO) in the peroxidase-oxidase reaction at pH 6.3 and its dynamic behaviour as the stationary concentration of reduced nicotinamide adenine dinucleotide (NADH) is changed. At low NADH concentration, simple periodic relaxation oscillations of large amplitude are observed. As the concentration of NADH is increased, MMOs arise. They start with a 1^1 state where one oscillation with large amplitude is followed by one oscillation of small amplitude. Further increase in NADH results in 1^i patterns where one large amplitude oscillation is followed by i small amplitude oscillations. The individual MMO states lose stability through period doubling sequences leading to narrow chaotic regions. These are followed by period-added regimes of MMOs. The period-adding sequence of MMOs culminates in a broad region of homoclinic chaos. The experimental results are compared with numerical simulations of a detailed model of the reaction.