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parameters are varied.

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## Dynamical Systems V: Bifurcation Theory and Catastrophe Theory

Definition. Bifurcation theory refers to the study of qualitative changes to the state of a system as a parameter is varied. It can be applied to steady state systems, or to dynamical systems and can be understood best at the level of a mathematical model, although recent techniques allow the method to be applied to experiments with feedback control.



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Bifurcation theory is the mathematical study of changes in the qualitative or topological structure of a given family, such as the integral curves of a family of vector fields, and the solutions of a family of differential equations. Most commonly applied to the mathematical study of dynamical systems, a bifurcation occurs when a small smooth change made to the parameter values of a system causes a sudden 'qualitative' or topological change in its behavior. Bifurcations occur in both continuous

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Bifurcation theory - Wikipedia

1.5. Bifurcation theory 12 1.6. Discrete dynamical systems 13 1.7. References 15 Chapter 2. One Dimensional Dynamical Systems 17 2.1. Exponential growth and decay 17 2.2. The logistic equation 18 2.3. The phase line 19 2.4. Bifurcation theory 19 2.5. Saddle-node bifurcation 20 2.6. Transcritical bifurcation 21 2.7. Pitchfork bifurcation 21 2.8.

Introduction to Dynamical Systems John K. Hunter  
The purpose of the present chapter is once again to show on concrete new examples that chaos in one-dimensional unimodal mappings, dynamical chaos in systems of ordinary differential equations, diffusion

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chaos in systems of the equations with partial derivatives and chaos in Hamiltonian and conservative systems are generated by cascades of bifurcations under universal bifurcation Feigenbaum ...

Bifurcation Theory of Dynamical Chaos | IntechOpen

In dynamical systems, a bifurcation occurs when a small smooth change made to the parameter values (the bifurcation parameters) of a system causes a sudden "qualitative" or topological change in its behaviour. Generally, at a bifurcation, the local stability properties of equilibria, periodic orbits or other invariant sets changes. 1

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An introduction to bifurcation theory

The above examples show some of the successes of bifurcation theory and dynamical systems approaches more generally in solving biological puzzles. They provide insights that are not possible from a biophysical or simulation approach. Beyond that, Fig. 2 hints at a deeper level of theory than the study of particular bursting systems. All of the examples we have considered arise from a common substrate with modest changes in parameters.

Dynamical systems theory in physiology

As a parameter is varied, the dynamical systems may have bifurcation points where the qualitative behavior

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of the dynamical system changes. For example, it may go from having only periodic motions to apparently erratic behavior, as in the transition to turbulence of a fluid .

Dynamical system - Wikipedia

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Dynamical Systems - Springer

Dynamical systems theory (also known as nonlinear dynamics, chaos theory) comprises methods for analyzing differential equations and iterated mappings.

It is a mathematical theory that draws on analysis, geometry, and topology – areas which in turn had their origins in Newtonian mechanics – and so should perhaps be viewed as a natural development within mathematics, rather than the ...

History of dynamical systems - Scholarpedia

The phase portrait of a dynamical system varies with the parameters. A bifurcation occurs when, as the parameter (s) pass through a critical value, a phase

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portrait that is topologically...

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