

V.I. Arnold

Catastrophe Theory

Translated from the Russian by
R. K. Thomas

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Contents: Singularities, Bifurcations, and Catastrophes. – Whitney's Singularity Theory. – Applications of Whitney's Theory. – A Catastrophe Machine. – Bifurcations of Equilibrium States. – Loss of Stability of Equilibrium and the Generation of Auto-Oscillations. – Singularities of Stability Boundaries and the Principle of the Fragility of Good Things. – Caustics, Wave Fronts and Their Metamorphoses. – Large-Scale Distribution of Matter in the Universe. – Singularities in Optimization Problems, the Maxima Function. – Singularities of Accessibility Boundaries. – Smooth Surfaces and Their Projections. – The Problem of Bypassing Obstacles. – The Symplectic and Contact Geometries. – The Mystics of the Catastrophe Theory. – References.

Catastrophe Theory is a new field; and its value has become an issue of heated controversy, not only among specialists but also in the popular press. It has been called a "revolution in mathematics" comparable with Newton's invention of the differential and integral calculus. While Newtonian theory only considers smooth continuous processes, **Catastrophe Theory** provides a universal method for the study of jump transitions, discontinuities, and sudden quantitative changes.

This little book, translated by R. K. Thomas from the Russian original, clearly explains what **Catastrophe Theory** is and why it has aroused considerable fervor among defenders and detractors. The book also contains uncontroversial results from the mathematical theories of singularities and bifurcation. Among the aspects described are studies of the shapes of caustics and wavefronts and of their metamorphoses, of the universal large-scale structure, of optimal control problems and of the calculus of variation singularities, of the singularities of visual contours, and of symplectic and contact geometries.

The author, a leading Soviet mathematician, illustrates fundamental results and their far-reaching applications in a style which will make sense to readers with a minimal background in mathematics. The book includes a series of remarkable figures, which form an integral part of the text.

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