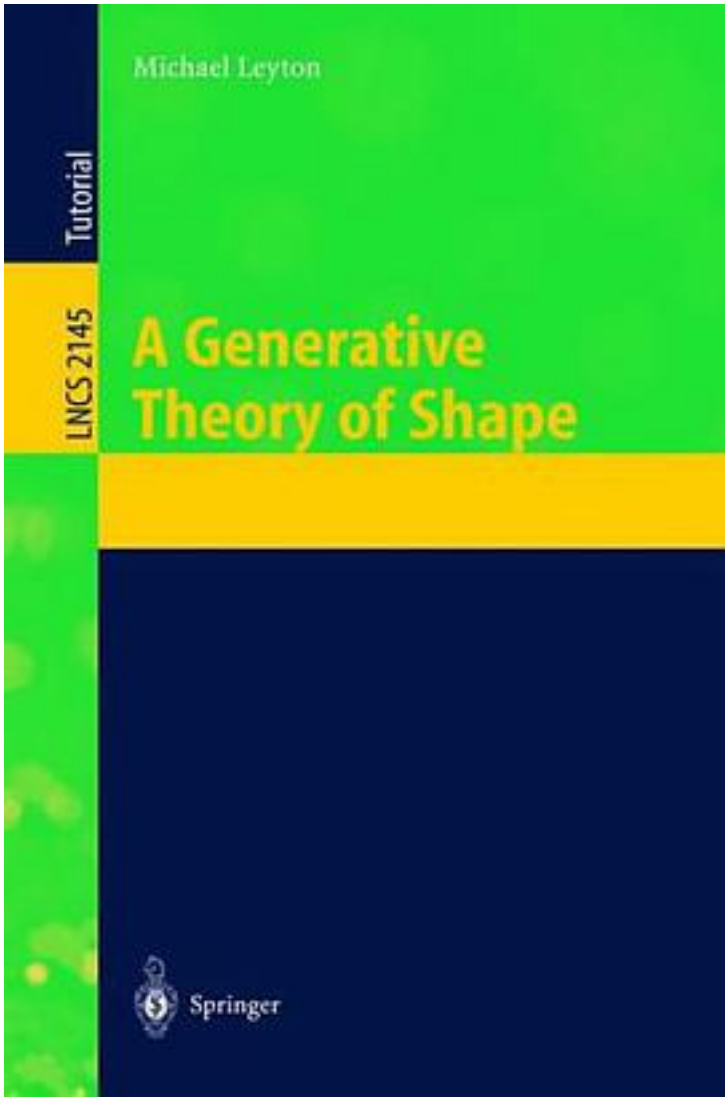
A Generative Theory of Shape



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著者:Michael Leyton

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The purpose of the book is to develop a generative theory of shape that has two properties regarded as fundamental to intelligence - maximizing transfer of structure and maximizing recoverability of the generative operations. These two properties are particularly important in the representation of complex shape - which is the main concern of the book. The primary goal of the theory is the conversion of complexity into understandability. For this purpose, a mathematical theory is presented of how understandability is created in a structure. This is achieved by developing a group-theoretic approach to formalizing transfer and recoverability. To handle complex shape, a new class of groups is developed, called unfolding groups. These unfold structure from a maximally collapsed version of itself. A principal aspect of the theory is that it develops a group-theoretic formalization of major object-oriented concepts such as inheritance. The result is a mathematical language that brings interoperability into the very foundations of geometry.

The book gives extensive applications of the theory to CAD/CAM, human and machine vision, robotics, software engineering, and physics. In CAD, lengthy chapters are presented on mechanical and architectural design. For example, using the theory of unfolding groups, the book works in detail through the main stages of mechanical CAD/CAM: part-design, assembly and machining. And within part-design, an extensive algebraic analysis is given of sketching, alignment, dimensioning, resolution, editing, sweeping, feature-addition, and intent-management. In robotics, several levels of analysis are developed for manipulator structure and kinematics. In software, a new theory is given of the principal factors such as text and class structure, object creation and modification, as well as inheritance and hierarchy prediction. In physics, a new theory is given of the conservation laws, and motion decomposition theorems in classical and quantum mechanics.

作者介绍:

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