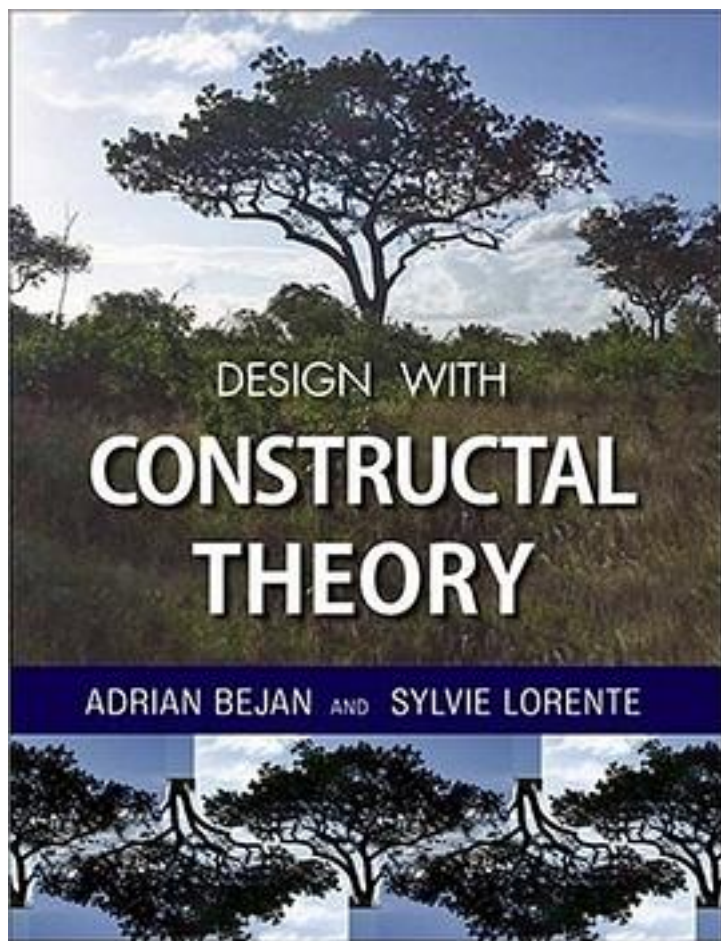


Design with Constructal Theory



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著者:Adrian Bejan

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Design course on the universal principle of configurations in nature and engineering-the constructal law Design with Constructal Theory offers a revolutionary new approach based on physics for understanding and predicting the designs that

arise in nature and engineering, from the tree and the forest to the cooling of electronics, urban design, decontamination, and vascular smart materials. This book shows how you can use the method of constructal theory to design human-made systems in order to reduce trial and error and increase the system performance. First developed in the late 1990s, constructal theory holds that flow architecture arises from the natural evolutionary tendency to generate greater flow access in time and in flow configurations that are free to morph. It unites flow systems with solid mechanical structures, which are viewed as systems for the flow of stresses. Constructal theory unites nature with engineering, and helps us generate novel designs across the board, from high-density packages to vascular materials with new functionalities (self-healing, self-cooling), and from tree-shaped heat exchangers to svelte fluid-flow and solid structures. Design with Constructal Theory starts with basic principles and then shows how these principles are applied to understanding and designing increasingly complex systems. Problems and exercises at the end of each chapter give you an opportunity to use constructal theory to solve actual design problems. This book is based on a design course developed by the two authors for upper-level undergraduates and graduate students at Duke University and other universities all over the world. With the authors' expert guidance, students and professionals in mechanical, civil, environmental, chemical, aerospace, and biomedical engineering will understand natural systems, and then practice design as science, by relying on constructal strategies to pursue and discover novel and effective designs.

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