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Book Review

A. Bejan, S. Lorente, *Design with Constructal Theory*, John Wiley & Sons, Hoboken, NJ, 2008, 528 pages, ISBN:978-0-471-99816-7.

Good ideas are fast moving streams that sweep and generate new fields. We see these in the new literature and, even more clearly, in new books. Constructal theory is one such field, and the new book by Adrian Bejan and Sylvie Lorente does justice to its growth and promise.

This treatise is written as a design course for last year undergraduate and first year graduate students in engineering. It was developed on several campuses all over the world, it is full of interesting and original design problems and examples, and is accompanied by a Solutions Manual. It teaches design as science, in particular thermo-fluid design, as a method of how to generate (how to discover) the configurations of complex flow systems based on principle. The physics principle that governs the phenomenon of generation of configuration in nature is the constructal law:

“For a finite-size flow system to persist in time (to live), its configuration must change in time such that it provides easier and easier access to its currents (fluid, energy, species, etc.)”

Design with Constructal Theory offers a revolutionary new approach to design 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. It is beautifully illustrated, in color and black & white.

The constructal design method unites flow systems with solid mechanical structures, which are treated as systems for the flow of stresses. The design examples unite nature with engineering, and help 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. Major segments of the treatise are: imperfection in design, optimal spacings, tree-shaped flows, multiscale high-density structures, multiobjective design, combined flows of fluids and stresses, distributed energy systems, and technology evolution in time. A major theme that runs through the book is the contemporary vascularization revolution that is sweeping technology, from smart multifunctional materials to compact heating, cooling and mass transfer.

The book is highly recommended to professors, students and professionals in mechanical, civil, environmental, chemical, aerospace and biomedical engineering. It is recommended to all the readers interested in design in nature, and in design as science, strategy, and novel and effective designs.

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