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The Many Faces of Elastica (English) Zbl 06755677

Forum for Interdisciplinary Mathematics 3. Cham: Springer (ISBN 978-3-319-61242-3 978-3-319-61244-7 - ebook), xv + 212 pp. (2017).

Review: This book provides an introduction to the mathematical aspects of Euler's elastic theory and its application. The approach is rigorous, as well as visually depicted, and can be easily digested. The first few chapters introduce the needed mathematical concepts from geometry and variational calculus. The formal definitions and proofs are always illustrated through complete derivations and concrete examples. In this way, the reader becomes acquainted with Cassinian ovals, Sturmian spirals, co-Lemniscates, the nodary and the undulary, Delaunay surfaces, and their generalizations. The remaining chapters discuss the modeling of membranes, mylar balloons, rotating liquid drops, Hele-Shaw cells, nerve fibers, Cole's experiments, and membrane fusion. The book is geared towards applied mathematicians, physicists and engineers interested in Elastica Theory and its applications.

MSC:

92-02 Research monographs (applications to natural sciences)

92B05 General biology and biomathematics

92C05 Biophysics

49S05 Variational principles of physics

Keywords:

geometry; variational calculus; biological membranes; surface tension and equilibria; equations of equilibrium states of membranes