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Nota di contenuto	Preface -- List of Symbols -- Geometry and Variational Calculus -- Plane Curves -- Space Curves -- Surfaces -- Variational Calculus -- Planar Curves Whose Curvature Depends Only on the Distance from a Fixed Point -- The Moving Frame Associated With a Plane Curve -- Integration -- Bernoulli's Lemniscates -- Relationship Between the Lemniscate and the Elastica -- Spirals -- Sturmian Spirals -- Generalized Sturm Spirals -- Serret Curves -- Cassinian Ovals -- Biological Membranes -- Subject Matter and Biological Membranes -- Types of Membranes -- Functions of Biomembranes -- Chemical Composition and Physical Properties of Biomembranes -- Membrane Models and Methods for the Study of Biomembranes -- Model Membrane Structures -- Surface Tension and Equilibrium --

Mechanical Equilibrium -- Tensions and Geometry -- Delaunay Surfaces -- Mylar Balloon and Elastic Curves -- Whewell Parameterization -- Elastic Sturmian Spirals -- Alternative Parametrization of Elastic Spirals -- Zero Tension -- Geometry of the Rotating Liquid Drop -- Introduction -- Geometry and Surface Invariants -- Parametrization via Legendre's Integrals -- Parameterization via Weierstrass's Functions -- Geodesics on the Drop -- Questions for Future Work -- Equations of Equilibrium States of Membranes -- Canham Model -- Key Assumptions in the Model -- Helfrich and Deuling Model -- Ou-Yang and Helfrich Model -- Symmetries of the Shape Equation -- Exact Solutions and Applications -- Unduloids and Nerve Fibers -- Mathematical Model of the Cole Experiment -- Fusion of Membranes -- Cylindrical Membranes -- Beyond Delaunay Surfaces -- Epilogue -- A Elliptical Integrals and Functions -- A.1 Jacobian Elliptic Functions -- A.2 Weierstrassian Elliptic Functions -- References -- Index.

Sommario/riassunto

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.