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Surfaces in Classical Geometries: A Treatment by Moving Frames (Universitext)

Gary R. Jensen, Emilio Musso, Lorenzo Nicolodi

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Designed for intermediate graduate studies, this text will broaden students' core knowledge of differential geometry providing foundational material to relevant topics in classical differential geometry. The method of moving frames, a natural means for discovering and proving important results, provides the basis of treatment for topics discussed. Its application in many areas helps to connect the various geometries and to uncover many deep relationships, such as the Lawson correspondence. The nearly 300 problems and exercises range from simple applications to open problems. Exercises are embedded in the text as essential parts of the exposition. Problems are collected at the end of each chapter; solutions to select problems are given at the end of the book. *Mathematica*®, Matlab™, and Xfig are used to illustrate selected concepts and results. The careful selection of results serves to show the reader how to prove the most important theorems in the subject, which may become the foundation of future progress.

The book pursues significant results beyond the standard topics of an introductory differential geometry course. A sample of these results includes the Willmore functional, the classification of cyclides of Dupin, the Bonnet problem, constant mean curvature immersions, isothermic immersions, and the duality between minimal surfaces in Euclidean space and constant mean curvature surfaces in hyperbolic space. The book concludes with Lie sphere geometry and its spectacular result that all cyclides of Dupin are Lie sphere equivalent. The exposition is restricted to curves and surfaces in order to emphasize the geometric interpretation of invariants and other constructions. Working in low dimensions helps students develop a strong geometric intuition. Aspiring geometers will acquire a working knowledge of curves and surfaces in classical geometries. Students will learn the invariants of conformal geometry and how these relate to the invariants of Euclidean, spherical, and hyperbolic geometry. They will learn the fundamentals of Lie sphere geometry, which require the notion of Legendre immersions of a contact structure. Prerequisites include a completed one semester standard course on manifold theory.

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