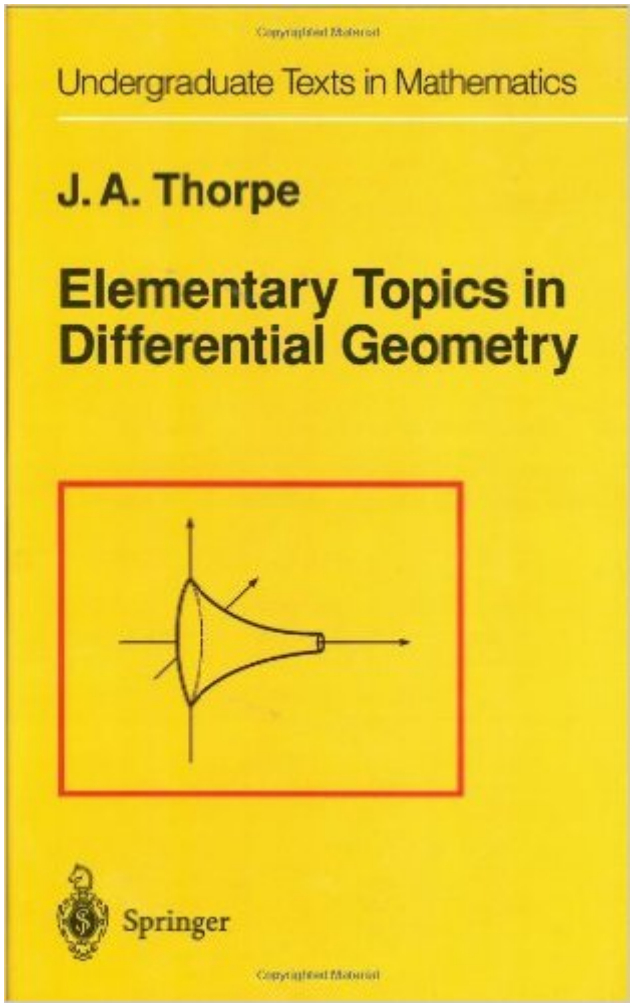
Elementary Topics In Differential Geometry (Undergraduate Texts In Mathematics)



Synopsis

In the past decade there has been a significant change in the freshman/ sophomore mathematics curriculum as taught at many, if not most, of our colleges. This has been brought about by the introduction of linear algebra into the curriculum at the sophomore level. The advantages of using linear algebra both in the teaching of differential equations and in the teaching of multivariate calculus are by now widely recognized. Several textbooks adopting this point of view are now available and have been widely adopted. Students completing the sophomore year now have a fair preliminary underÂ- standing of spaces of many dimensions. It should be apparent that courses on the junior level should draw upon and reinforce the concepts and skills learned during the previous year. Unfortunately, in differential geometry at least, this is usually not the case. Textbooks directed to students at this level generally restrict attention to 2-dimensional surfaces in 3-space rather than to surfaces of arbitrary dimension. Although most of the recent books do use linear algebra, it is only the algebra of ~3. The student’s preliminary understanding of higher dimensions is not cultivated.

Book Information

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Customer Reviews

This book could be considered as the second semester of an advanced calculus course and serves as an excellent introduction to differential geometry. The approach is rigorous, but the author does employ a great deal of illustrations to explain the relevant concepts. The first five chapters cover vector fields on curves and surfaces. The many concrete examples given by the author illustrate effectively the normal and tangent vector fields. The Gauss map is then appropriately introduced in

Chapter 6 and shown to be onto for compact, connnected, oriented n-dimensional surfaces in n+1-dimensional Euclidean space. This is followed by a discussion of geodesics and parallel transport in the next two chapters. The important concept of holonomy is introduced in the exercises along with the Fermi derivative. These ideas are extremely important in physical applications and must be understood in depth if the reader is to go into areas such as general relativity and high energy physics.The next chapter considers the local behavior of curvature on an n-surface via the Weingarten map. The important concept of the covariant derivative is introduced. The concept of a geodesic spray, so important in the theory of differential equations, is introduced in the exercises. The curvature of plane curves is treated in Chapter 10 with the circle of curvature introduced. The Frenet formulas, which relate the tangent and normal vectors to the curvature and torsion, are discussed in the exercises. The curvature of surfaces is discussed later in Chapter 12 with the first and second fundamental form introduced, along with the very important Gauss-Kronecker curvature. And in this chapter the author introduces the idea of local and global properties of an n-surface.

Analysis (Undergraduate Texts in Mathematics)