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BOOK REVIEW

Lectures on Differential Geometry, by Iskander A. Taimanov, European Mathematical Society, Zürich, 2008, viii + 221pp., ISBN 978-3-03719-050-0.

In this book the author gives an introduction to the basics of differential geometry by keeping in mind the natural origin of many geometrical quantities, as well as the applications of differential geometry and its methods to other sciences.

The book is divided into three parts. The first part - Curves and Surfaces, is structured into Chapter 1 and Chapter 2.

In the first chapter the author gives: a definition of regular parameterized curve in the Euclidean space $\mathbb{R}^n$; length and arclength parameter of such curve; the Frenet formulas and natural equations for a plane curve and a curve in three-dimensional space; the proof, that the natural equations determine the curve up to motion of the space; a definition of k-dimensional smooth submanifold in $\mathbb{R}^{n+k}$; the proof, that ortogonal group $O(n)$ is an $\frac{n(n-1)}{2}$ - dimensional submanifold in $\mathbb{R}^{n^2}$.

The second chapter is devoted to the differential geometry of regular surfaces (two-dimensional smooth submanifold) in $\mathbb{R}^3$. The chapter contains the following themes: metric on regular surfaces and curvature of a curve on a surface; derivational equations and Bonnet's theorem; the Gauss theorem; covariant derivative and geodesics; the Euler-Lagrange equations, the Gauss-Bonnet formula; minimal surfaces.

The second part - Riemannian geometry, is splited into three chapters - 3, 4 and 5.

Chapter 3 provides the foundations of: topological spaces; topological manifolds; smooth manifolds; submanifolds; smooth maps; tensors; the tangent bundle TM and the cotangent bundle T^*M of a smooth manifold M; the action of maps on tensors, Lie derivative of a tensor field along a vector field. The theorem that the tangent bundle TM carries the structure of a smooth manifold such that the projection $\pi : TM \to M$ is a smooth map and every point $x \in M$ has a neighbourhood U such that the inverse image $\pi^{-1}(U)$ of U is diffeomorphic to the direct product $U \times \mathbb{R}^n,\ n = \dim M$, is proved. The theorem that every closed smooth