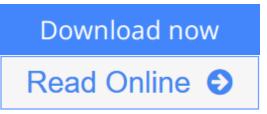
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By Zhong-Can Ou-Yang, Ji-Xing Liu, Yu-Zhang Xie



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This book contains a comprehensive description of the mechanical equilibrium and deformation of membranes as a surface problem in differential geometry. Following the pioneering work by W Helfrich, the fluid membrane is seen as a nematic or smectic — A liquid crystal film and its elastic energy form is deduced exactly from the curvature elastic theory of the liquid crystals. With surface variation the minimization of the energy at fixed osmotical pressure and surface tension gives a completely new surface equation in geometry that involves potential interest in mathematics. The investigations of the rigorous solution of the equation that have been carried out in recent years by the authors and their co-workers are presented here, among which the torus and the discocyte (the normal shape of the human red blood cell) may attract attention in cell biology. Within the framework of our mathematical model by analogy with cholesteric liquid crystals, an extensive investigation is made of the formation of the helical structures in a tilted chiral lipid bilayer, which has now become a hot topic in the fields of soft matter and biomembranes.

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