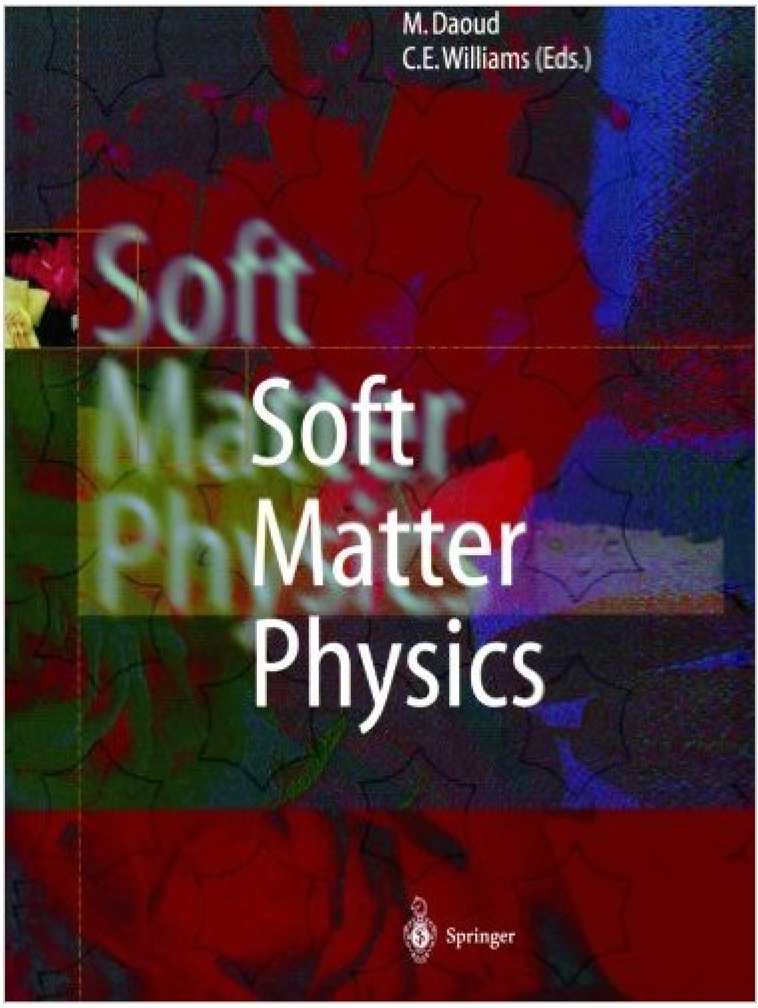
Soft Matter Physics



Synopsis

In a liquid crystal watch, the molecules contained within a thin film of the screen are reorientated each second by extremely weak electrical signals. Here is a fine example of soft matter: molecular systems giving a strong response to a very weak command signal. They can be found almost everywhere. Soft magnetic materials used in transformers exhibit a strong magnetic moment under the action of a weak magnetic field. Take a completely different domain: gelatin, formed from colÂ-lagen fibres dissolved in hot water. When we cool below 37Â C, gelation occurs, the chains joining up at various points to form a loose and highly deformable network. This is a natural example of soft matter. Going further, rather than consider a whole network, we could take a single chain of flexible polymer, such as polyoxyethylene [POE = (CH CH O)N, 2 2 5 where N rv 10], for example, in water. Such a chain is fragile and may break under flow. Even though hydrodynamic forces are very weak on the molecular scale, their cumulated effect may be significant. Think of a rope pulled from both ends by two groups of children. Even if each girl and boy cannot pull very hard, the rope can be broken when there are enough children pulling.

Book Information

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Customer Reviews

Soft Matter Physics is an excellent compilation of chapters on different aspects of soft matter, written by the experts in their respective areas. In more ways than one, this text complements the texts of Chaikin & Lubensky as well as the one by Witten, and can be used wfor classroom teaching.F. Brochard_Wyart’s chapter on droplets describes some really elegant and simple experiments to introduce diverse concepts related to wetting and capillarity. A greater depth and detail about this area is found in a recently published treatize on Capillarity and Wetting Phenomenon, that she co-authored with David Quere and PG deGennes. The second chapter on fractals by Daoud and Van Damme presents introductory ideas of the mathematics of self-similarity, fractals, and random walks. Next follows an insightful foray into colloidal matter where J. C. Daniel and R. Andibert discuss the central role of interaction forces in describing the stability and aggregation behavior of colloids. The following two chapters focus on surfactants, where C Taupin and G. Porte examine the physiochemistry and the phase behavior of surfactant molecules.F Candau then talks about the polymers formed by self-assembly and L Monnerie follows it up with description of the physical properties of covalently linked polymers. Thereafter comes a chapter by Tom Witten, which beautifully strings together the concepts of fractals, random walks, phase behavior into a discussion on the behavior of polymers in solution. This chapter is written in his trademark elegance, so apparent in his own treatize on soft matter, titled Structured Fluids. The last chapter on Liquid Crystals by J. Prost and C. E. Williams dwells on the characteristic properties of the nematic, smectic and columnar phases. With PG de Gennes, J. Prost is co-author on detailed text on liquid crystals.It is only befitting that the forward to this text is written by PG de Gennes himself, for besides his fundamental contributions to the field, he has shaped and influenced the research of all the contributors and of readers worldwide. I recommend this book to one and all, and I am sure that even if your research area is constrained to topics described in any one chapter, you will find the reading of the rest text as purposeful and illuminating.

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