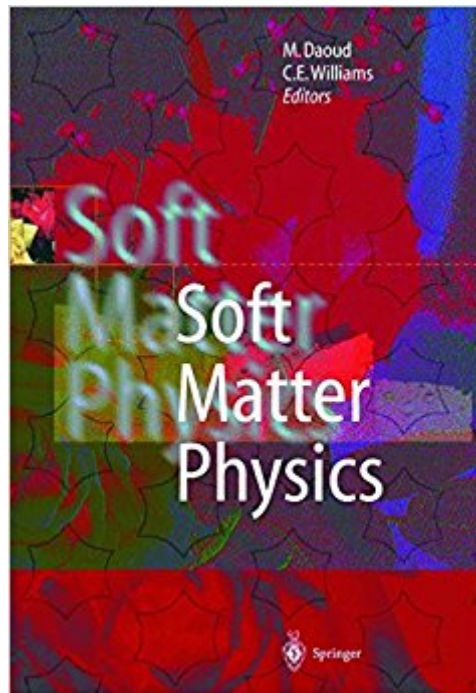




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Soft Matter Physics



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 collagen fibres dissolved in hot water. When we cool below 37°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 = $(\text{CH}_2\text{CH}_2\text{O})_N$, $2 \leq N \leq 10$], 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

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"I think that in these days when the number of students in physics and chemistry is declining steadily, it is necessary to adapt the high school curricula, leave out part of the physics of past

centuries, and present more modern topics to young people. I would like to suggest that soft matter physics can be one of these subjects. This subject is linked with many phenomena in the real world, there are beautiful and simple experiments that can be performed, the mathematics to describe these systems is in itself fascinating (I already mentioned fractals, but some theories that describes the shapes of membranes and vesicles are cousins of those used in string theory) and finally, these products are of high technological value. This book is a rich source of inspiration for starting such a course."Physicalia, 2000/36/3 (..) The book design is catching with instructive and inspiring figures, which are often in colour and are of outstanding quality. (...) It awakes a love for the themes covered. It is a beautiful and nobly designed book, written with much didactic commitment. Translated from the review of K. Stierstadt, Physikalische Blätter, 2001, 57, 5.

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 for 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 treatise 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 treatise 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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