frequency f. Esteve discusses the prospects of using these devices for metrology. Although the precision of such frequency-to-current converters is still too crude, they might eventually eliminate the kilogram—from which the ampere is presently derived—from our set of standards.

I expect that single-electron tunneling will continue to be a subject of much attention for the next few years. To my knowledge there are no other monographs on this subject, so those who intend to become experts will find this book quite valuable.

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Interfacial Transport Processes and Rheology

David A. Edwards, Howard Brenner and Darsh T. Wasan
Butterworth-Heinemann, Boston, 1991. 558 pp. $75.00 hc ISBN 0-750-69185-9

As this review is being composed, thousands of gallons of light crude oil are spewing into the ocean from a tanker marooned off the Shetland Islands. In a distant time under less disturbing circumstances, Pliny the Elder observed that "divers sprinkle oil from their mouth because it calms the rough element and carries light down with them." Situations that evoke very different emotions often involve the exact same physics. Those currently interested in soft condensed matter, especially complex fluids such as liquid–liquid emulsions and gas–liquid foams, follow Lord Kelvin, J. A. F. Plateau, Lord Rayleigh and Josiah Willard Gibbs by engaging the physics of the interfacial region separating two fluids.

Interfacial Transport Processes and Rheology is a comprehensive graduate-level textbook concerned with the theory, measurement and application of interfacial hydrodynamics. The text is divided into two complementary parts. Part I occupies most of the book and adopts the classical, macroscopic view of fluid interfaces as idealized, two-dimensional singular surfaces. The adsorption of molecular or macromolecular surfactants imparts intrinsic rheological properties to the interface such as interfacial shear and dilatational viscosities (which are two dimensional counterparts of the three dimensional viscosities possessed by bulk-phase fluids) and Gibbs elasticity, which indicates the change in interfacial tension with area. Gradients in surfactant concentration and temperature cause interfacial tension gradients that produce Marangoni phenomena such as the "tears" of strong wine. This text focuses successfully on predicting and understanding the separate and coupled roles of these intrinsic and extrinsic mechanisms of interfacial response.

The first two chapters of Part I include an illuminating introduction to interfacial phenomena, a short historical review, a qualitative discussion of the physicochemical aspects of interfacial behavior and an overview of important applications. The next three chapters provide a mathematical foundation and develop the field equations that govern the bulk and interfacial transport of momentum, mass, chemical species, energy and so on. These chapters provide deep insight into the physical and mathematical roles of the interface in supplying boundary conditions for the neighboring bulk phases. The text draws parallels and emphasizes differences between the interface and the bulk. The book includes numerous worked examples, questions and suggestions for additional reading at the end of each chapter. (A solution manual for instructors is available from the publisher.)

The next four chapters are devoted to the measurement of interfacial rheological properties. A balanced view is provided of the successes and problems, direct and approximate experimental techniques, and absolute and apparent physical properties that are associated with the condition of interfacial stress. Some highlights of the experimental sections include discussions of light-scattering techniques and the deep-channel viscometer for measuring interfacial shear viscosity. The last five chapters in Part I cover important applications such as Rayleigh and Bénard instabilities, interfacial turbulence, thin-liquid-film hydrodynamics and stability, and the rheology and stability of foams and emulsions. The discussion of the role of disjoining pressure and the use of Derjaguin-Landau-Verwey-Overbeek (DLVO) theory to understand the metastability (as opposed to the retarded but inevitable demise) of complex fluids are of interest to scientists and technologists alike, and they illustrate the broad appeal of the applications chapters.

Part II pursues a more detailed microrheological view of a three-dimensional interfacial region: It uses rigorous perturbation techniques to develop a generic surface-excess theory for nonmaterial interfaces that is consistent with the classical approach. This theory may elucidate the molecular origins of interfacial phenomena and ultimately unify statistical mechanical and continuum mechanical approaches. The presentation parallels that on field equations in Part I and concludes with a chapter on the three-phase contact line (not covered in Part I but described by the Neumann–Young equation in the classical approach).

I highly recommend this textbook to serious students, teachers, technologists and researchers in this field.

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Exploring Music: The Science and Technology of Tones and Tunes

Charles Taylor
IOP, Bristol, UK (US dist., AIP, New York), 1992. 255 pp. $35.90 pb ISBN 0-7503-0213-5

The foreword of this book advises us that "Every year, ever since 1826, the Royal Institution has invited an eminent scientist to deliver a course of lectures at Christmastide in a style 'adapted to a juvenile auditory,' to use the words of Michael Faraday, who initiated the tradition." In practice the audience may range in age from under 10 to over 80.

Charles Taylor, a physicist who is an expert in crystal and optical phenomena, author of ten other musical books, and sometime professor of physics at the University of Wales, delivered the Christmas lectures in 1971 and again in 1989. The first series of lectures was published by the BBC as *Sounds of Music*. The book reviewed here is an expanded version of the 1989 lectures.

The book is charming in its descriptions of demonstrations by great men of the past and for illustrations of the apparatus they used. These include three used by John Tyndall, one demonstrating that sound will not travel through a vacuum. It is chastening to be reminded that effective acoustical and musical experiments predated electronic gadgets and computers. But electronics and computers also have their place in this wide-ranging book.

The variety of material covered would challenge the powers of any author. My reading is that Taylor is best in the physics of traditional musical instruments. He refers often to the work of the late Arthur Benade,