Will Tenure Survive as Money Shrinks and Adjunct Faculty Ranks Swell?

The Questions of Tenure

Edited by Richard P. Chait
Harvard U. Press, Cambridge, Mass., 2002. $35.00 (334 pp.). ISBN 0-674-00771-9

Reviewed by David Seligman

Richard Chait, who edited *The Questions of Tenure* and wrote 3 of its 11 chapters, is arguably the best known and most authoritative voice in the US on tenure and faculty governance in higher education. From the outset, Chait makes clear that he does not intend either to advocate or to oppose the institution or practices of academic tenure. In contrast to more partisan views such as Matthew Finkin's *The Case for Tenure* (ILR Press, 1996) and Charles Syke's *ProfScam: Professors and the Demise of Higher Education* (St. Martin's Press, 1988), Chait intends his book to provide a scholarly analysis, and to present "research-based, data-driven answers to important, practical, and frequently posed questions about tenure policy and practice" (p. 2). Little else fills this niche, other than the much earlier *Faculty Tenure* (Jossey–Bass, 1973), by William Keast and John Macy Jr, and Chait's own previous works, including *Beyond Traditional Tenure* (Jossey–Bass, 1982), which he coauthored with Andrew Ford.

The scope of the book is impressively grand, yet appropriately focused. The chapters address separate but connected questions. Chait begins with his own clear and convincing account of why the debate about tenure has gained new life after a period of latency. In chapter 2, Cathy Trower provides a basis for later chapters by analyzing current faculty personnel policies—traditional and nontraditional—at more than 200 US colleges and universities. Chait returns in chapter 3 to examine the relationship between tenure and governance at eight diverse small colleges. Then, R. Eugene Rice and Mary Deane Sorcinelli compare perceptions and practices in the tenure process by way of exploring whether the process can be improved.

Roger Baldwin and Jay Chronister consider the policy and quality implications of recent shifts away from tenure-track appointments in some higher-education sectors. Next, Philip Altbach contrasts how academic freedom of faculty is protected (or not) in the US and abroad. Trower examines how institutions that do not grant tenure have attracted and retained faculty. Charles Clotfelter continues that theme through the question, Can faculty be induced to relinquish tenure? In a thought-provoking case study, William Mallon discusses six small colleges that have pursued opposite strategies. Three of the colleges replaced tenure with contract systems and three replaced contract systems with tenure, but all six reported that their decisions to promote faculty increased accountability and improved performance. Then, Trower and James Honan use two data-driven initiatives to suggest how faculty tenure policies might be helped by constructive use of data.

In the final chapter, Chait distills insights from the previous chapters. He notes that no single tenure system exists in the US because tenure has evolved on significantly different alternative paths. As Chait puts it, "Context counts." Despite institutional differences, faculty perceive no acceptable substitute for tenure, so little "internal market" exists for tenure reform. Nevertheless, legislators, trustees, and others continue to exert pressure to reexamine faculty employment practices and policies. Such pressure may be abetted by dissatisfaction, not particularly from faculty within traditional tenure tracks, but from faculty within the swelling ranks hired outside the tenure tracks.

The Questions of Tenure deserves a careful reading from academic administrators, trustees, and legislators concerned with sustaining academic quality in the face of financial constraints. It also should be read by faculty members, particularly those who may find themselves in the position of making "up or out" decisions about their academic colleagues. It is the single most useful resource to appear in the field for many years.

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Hydrogen: The Essential Element

John S. Rigden
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John S. Rigden's book, *Hydrogen: The Essential Element*, could be subtitled, "The Hydrogen Atom's Impact on Physics in 23 Nutshells." The book begins in chapter 1 with the creation of protons in the big bang and ends in chapter 23 with such hydrogen exotica as positronium and Rydberg atoms. In between are engaging discussions of topics that include the invention of nuclear magnetic resonance, the discovery of the Lamb shift and the anomalous magnetic moment of the electron, and the hydrogen atom's role in the birth of quantum mechanics.

Rigden, special projects director of the American Institute of Physics, is personally familiar with many of the heroes of these nutshells and with the importance of their work. His mastery of the subject has helped give the narrative vividness and accuracy that are seldom matched in semipopular science books.

The book contains a wonderful collection of anecdotes, many new to me, about famous physicists whose lives were touched by the hydrogen atom. For example, pages 132–133 contain a bittersweet description of how graduate student Norman Ramsey worked himself out of a thesis topic by finding magnetic-resonance lineshape anomalies that led to the discovery of the deuteron's quadrupole moment. "Since Rabi sensed that something significant lurked in the peculiar signal shapes, he invited other members of his research team to participate in this potentially important experiment. As a result, Ramsey had to find another dissertation topic."

Complementing the text are good photographs both of people and of historically interesting data. For example, a telling series of three resonance curves, for beams of molecular hydrogen and deuterium, shows the progression from Ramsey's first, rather noisy signals to later beautifully resolved resonances of I. I. Rabi's group from which the electron's quadrupole moment was determined. The quadrupole moment showed that the force between protons and neutrons was not purely central but had a substantial, spin-dependent tensor component.

Each chapter is self-contained and is just the right length for 5 or 10 minutes of light reading before bedtime. Equations are limited to such simple examples as Balmer's formula for the wavelengths of the hydrogen spectra, and Dirac's deceptively simple version of the Schrödinger equation.

A few more diagrams of basic experimental arrangements would have been helpful to the nonexpert reader. For example, the book has many discussions of spectral lines, but no diagram of the refraction of light into its constituent colors, something that even Isaac Newton considered essential for his celebrated *Opticks*.

Although Rigden gives credit to experimentalists, he reserves his most reverent passages for theorist heroes. His emphasis on theory causes some eccentricities in the historical perspective. For example, there are three references to "spin" in the index, two to the Dirac theory of the electron and one to the respective integer and half-integer spins of bosons and fermions. Samuel Goudsmit's name does not appear in the index. Goudsmit's noted colleague George Uhlenbeck is mentioned in a single sentence: " 'The Schrödinger theory came as a great relief,' said George Uhlenbeck, the codiscoverer of the electron spin" (p. 81).

Although precise studies of the hydrogen atom have had enormous and indisputable importance in the development of physics, one might question the primacy that Rigden assigns to hydrogen. Studies of the alkali-metal atoms have had comparable importance in the development of atomic clocks and in the discovery of the Fraunhofer D lines, electron spins, and Bose–Einstein condensation. Silicon, which launched salient developments in condensed matter physics, underpins our information age. Rigden makes little mention of accelerators, which have been essential for our understanding of the subatomic world. True to its title, the book keeps hydrogen as the guiding theme.

I intend to keep *Hydrogen: The Essential Element* close at hand as I prepare lectures on quantum mechanics. The personalities of scientists who have revealed the rich physics of the hydrogen atom shine through clearly, and will help to capture the imagination of new generations of young scientists.

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Higher-Order Numerical Methods for Transient Wave Equations

Gary C. Cohen
Springer–Verlag, New York, 2002. $69.95 (348 pp.).
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Problems involving wave propagation occur in many disciplines, including acoustics, electromagnetics, geophysics, elasticity, and fluid dynamics. Long ago, in *Methods for the Approximation of Time Dependent Problems* (GARP Publications Series, No. 10, 1973), Heinz-Otto Kreiss and Joseph Oliger advocated the use of high-order discretization for such problems, especially for long-time integration. Kreiss and Oliger argued that the number of grid points needed in a unit interval of wavelength depends on the time interval of integration: The higher the formal order of the discretization scheme, the weaker is its dependence on the time interval. To my knowledge, *Higher-Order Numerical Methods for Transient Wave Equations*, by Gary C. Cohen, is the first book to address specifically the use of high-order discretizations in the time domain to solve wave equations. Traditionally, the engineering community solved such problems in the frequency domain, but recently have tended to abandon that harmonic approach amid an increase of interest in complex pulselike sources containing a large range of frequencies. Cohen, a researcher at the French National Institute for Research in Computer Science and Control (INRIA), has been working on this topic for more than 15 years.

The book is divided into three parts. Part 1 (chapters 1–3) presents the governing equations for acoustics, electromagnetism, and material elasticity. This part provides a useful overview of functional spaces and introduces the appropriate Sobolev spaces. Chapter 3 presents plane-wave solutions to Maxwell's equations and to the elastics system. This chapter is useful, but touches only briefly on the major issue of boundary conditions.

Part 2 of the book (chapters 4–10) deals with construction of second- and fourth-order standard finite-difference schemes for both space and time. The material is fairly standard except for the modified-equation approach introduced in the mid-1980s, which evolved to uniform fourth-order spatiotemporal schemes. The notation in chapter 4 is perhaps unnecessarily heavy: It renders cryptic and hard-to-recognize even simple Taylor expansions that should be familiar to undergraduate students! I also expected to find more on compact (implicit) schemes and treatment of stability issues associated with boundary conditions—including reduction of the order of accuracy at the boundaries. However, the book does not contain such material. A one-line reference to spectral methods dismisses them as ". . . very difficult to implement . . ."(p. 57). Other topics in part 2 include stability of the discrete schemes (including energy techniques), numerical dispersion and anisotropy, reflection-transmission analysis, and construction of schemes in heterogeneous media. The description is quite rigorous but easy to follow, and the remarks at the end of each section are very useful.

Part 3 (chapters 11–14) presents various finite-element formulations and contains by far the most interesting material in the book. The key development in the use of finite elements in this context is the mass-lumping concept. In mass lumping, one constructs a diagonal mass matrix in a way that does not impair the formal accuracy of the finite-element discretization. The author presents mass lumping in detail, although his account of its history is somewhat erroneous. The use of Gauss–Lobatto points was introduced at MIT in the early 1980s in the context of spectral elements. In talking about the MIT contribution, the author refers to spectral elements as any finite elements of order higher than three and thus seems to contradict the vast majority of literature on the subject. The quadrilateral/hexahedral elements favored by the author have good approximation properties. However, the author seems unaware that tensor-product bases developed in the past 10 years make triangular/tetrahedral elements competitive with—perhaps even better than—quadrilateral/hexahedral ones. Therefore, the text's discussion entitled "Tetrahedra or Hexahedra?" is not justified.

The section in Part 3 on mixed formulations, which is quite good, extends the classical finite-difference Yee scheme to finite elements. For