admitted into schools for boys, and what the social consequences of these various measures might be. If the rhetoric of past decades is no longer recognizable, the questions still resonate with parents, students, and educators today. Hulin has provided a set of helpful and very detailed historical references that not only offer the historian of science an opportunity to explore the ways in which scientific production is connected to its reproduction and transmission but also provide today's teachers with both a historical perspective and an opportunity to reflect on the nature of their work and the changes in the curriculum they are asked to make.

SOFIE LACHAPELLE

Karl-Eugen Kurrer. *The History of the Theory of Structures: From Arch Analysis to Computational Mechanics*. 848 pp., illus., bibl., indexes. Berlin: Ernst & Sohn, 2008. €119 (cloth).

Inspired to research and write the history of structural engineering, engineers often find it difficult to know for whom they are writing: historians, engineers, students, or dilettantes. Their readers may find it similarly difficult to understand what they are writing about. The primary means of communication available to an engineer—the derivation and comparison of formulas and diagrams for analysis of a structure—is inaccessible to lay readers, while the careful development of a historical narrative and the presentation of themes underlying the biographies of significant figures and the sequences of events are often beyond the capabilities of engineers. Two examples of works that have transcended this problem are Jacques Heyman's *The Stone Skeleton* (Cambridge, 1995), on the development of methods of arch analysis, and David Billington's *The Tower and the Bridge* (Basic, 1983), which analyzes the development of concrete shell and bridge structures. Underlying these two authors' biographical and evolutionary analyses is a clear theme, which the reader can follow through their complex narratives.

The History of the Theory of Structures is written by an engineer with a passionate interest in the history of the analysis of structures. Karl-Eugen Kurrer presents a series of essays; he begins with eleven brief introductory statements, followed by a longer essay on the theory of structures and applied mechanics. Discussions follow on the theories of the masonry arch, the analysis of structures to the end of the nineteenth century, metal structures (dealing exclusively with developments in Germany), space frames, reinforced concrete, and structural analysis in the twentieth century. In his final essay, "Perspectives for Theory of Structures," Kurrer presents a rationale for teaching the theory of structures in a way that is based on their history and development through time. Seventy-five biographical sketches are appended to the book.

For the time span covered (1575 to the present), this is the most complete recent book on the topic of methods of structural engineering design. Another recent work, Bill Addis's *Building: Three Thousand Years of Design, Engineering, and Construction* (Phaidon, 2007), covers similar topics over a longer period, with an additional emphasis on architecture and construction. Both books initiate a discussion of contemporary developments, such as the widespread application of the finite element method, as part of a historical continuum. In addition to presenting biographies of the key contributors to the theory of structures, their interrelationships, and the environments in which they worked, Kurrer explores other themes in the course of his book. For one, he describes the development and eventual dominance of elastic theories of structural behavior for wood, masonry, and metal structures. The later replacement of elastic theories with plastic theories for the design of steel structures is analyzed in the essay on metal structures. Kurrer describes explicitly how Emile Clapeyron, an expositor of Sadie Carnot's work on the conversion of chemical to mechanical energy, came to apply similar principles to beams and trussed frameworks. Well-known works of engineering, such as Gustav Eiffel's Gabarit viaduct, are mentioned in the context of discussion of the methods of analysis employed in their design. Other themes are much more difficult to follow: efforts to show that structural theories are instruments of production and can be analyzed in Marxist terms seem misplaced. An obscure introductory chapter on applying philosophical principles to understanding the means and purpose of engineering science is occasionally mentioned throughout the work, contributing very little. The introduction of literary and artistic themes often seems gratuitous, beginning with the invitation to Josef K., the protagonist of Franz Kafka's *The Trial*, to ignore the imagined gatekeeper who is preventing him from entering into the study of structural analysis (p. 28).

Much of the book will be accessible only to engineers. In his "Invitation to a Journey through the History of Structures," Kurrer invites the reader (in verse), "But I bid of you just one thing: / Do not be afraid of formulas!" (p. 29). True to his word, Kurrer's discussions

reflect a delight in the power of symbolic manipulations in linear algebra, calculus, and applied mechanics to explain structural behavior. Because of the casual juxtaposition of history and biography with such mathematical manipulations, and because of the diversity of the themes Kurrer introduces, it is very difficult to discern the purpose of this work and its intended audience. The prose adds to this confusion. Especially in the introductory sections (pp. 20–141), the writing is at best difficult and at worst garbled and obscure: "But they [Jacques Heyman and Emil Winkler] transcend the epistemological recourse insofar as their reconstruction of the history of masonry arch theory does not simply reproduce the cognition horizon of current science on a particular object, but reproduce it in expanded form" (p. 245). Two other factors add to the confusion. Kurrer coins terms without clarifying them for the reader—for instance, "historicological," "historico-critical," and "static-constructional." He also applies important concepts before introducing them, as in his reference to "the three prime tasks of thrust line theory" (p. 217) or his use of the term "kern point moments" (p. 229).

The book is subject to other lapses as well. Authorial comments inserted into narratives and quotations and other digressions are very distracting. In a number of instances, Kurrer has to say "But back to . . . " (e.g., p. 362). Much extraneous information could be inserted into endnotes, leaving the main narrative less encumbered. Book and article titles in German, and occasionally French, are translated in brackets in the text, while Italian and Spanish titles are left without translation. Translation also presents other difficulties: for instance, the final piece in the "jigsaw" is frequently invoked (e.g., p. 121), and at one point we are told that "the historical epistemology relieves itself from its philosophical foundations" (p. 244).

It is difficult to assess the significance of *The History of the Theory of Structures*. The presence, in one volume, of such a significant body of hard-won biography, bibliographical material, and information lend the book intrinsic value. But the problems in Kurrer's presentation, the introduction of extraneous elements, the lack of a clear direction to the narrative, and the inaccessibility of much of the material to nonengineers make the author's point of view difficult to determine, difficult to follow, and, ultimately, difficult to credit.

THOMAS BOOTHBY

James E. McClellan III (Editor). *The Applied-Science Problem.* (Based on papers presented at a workshop at the Stevens Institute of Technology, 6–8 May 2005.) 221 pp., illus. Jersey City, N.J.: Jensen/Daniels Publishers, 2008. $18.95 (paper).

At first sight this collection of ten essays might seem annoyingly eccentric, given the mixture of chatty colloquialisms (Nick Taylor on LASER) with structured analysis (George Smith on creativity or Harold Dorn on the Kelly-Bessemer process), considered length (Keith A. Neir on illustrating science as a subset of technology via spectrometry) with definitive brevity (Philip R. Reilly on biotechnology), footnotes that use crazily archaic symbols replacing familiar numerals, bibliographies ranging from zilch to the very useful spectrometry listing by Neir, and the complete absence of any index! Add to this a criminal multitude of typos in text and footnotes. But persevere, please, for there is little of self-indulgence, a firm if unseen editorial hand, and a great deal of food for thought in this ebullient collection arising from a workshop devoted to the "applied-science problem" held at the Stevens Institute of Technology in May 2005.

On the basis of this selection of papers, the overall message from the workshop would seem to run something as follows: viewing technology as applied science is fundamentally ahistorical and an "obstacle to deeper understanding" (p. i) of the manner in which "knowledge systems" relate or may be related to change and maintenance of systems of material production. This position arises from consideration of a range of recent formulations, from Thomas Hughes's conception of the technological system as being both emotively and logistically incapable of maintaining disciplinary boundaries to the work of those writers on knowledge systems (several represented in this volume) who center on the clear truth that knowledge "of nature does become transmuted into technologies" (p. 26). Finally, the goal of the collection is to "generalize and produce a new taxonomy for the applications of science in technology" (p. 29).

The message is useful and timely, and on one or two occasions the parts are even greater than this sum. George Smith's essay on creativity in technology begins with the simple but surely noteworthy point that any useful notion of application cannot limit itself to "eureka" science and breakthrough technology but must allow for the cases of normal, routine science and of technology advances that owe something but by no