LEONHARDI EULERI COMMENTATIONES MECHANICAE AD THEORIAM MACHINARUM PERTINENTES VOLUMEN POSTERIUS. Series secunda. Opera mechanica et astronomica. Vol. 16. Bern (Societatis Scientiarum Naturalium Helveticae). 1979. xvii + 327 pp.

LEONHARDI EULERI COMMENTATIONES MECHANICAE ET ASTRONOMICAE AD SCIENTIAM NAVALEM PERTINENTES VOLUMEN POSTERIUS. Series secunda. Opera mechanica et astronomica. Vol. 21. Bern (Societatis Scientiarum Naturalium Helveticae). 1978. ccxlii + 241 pp.

Reviewed by Robin E. Rider
History of Science and Technology Program
The Bancroft Library
University of California, Berkeley
Berkeley, CA 94720

With the publication of these two volumes of the Euler *Opera omnia*, the second series, "Opera mechanica et astronomica," nears completion. Volumes 16 and 21 share a common theme: the mechanics of fluids and its applications. They are thus closely linked with other volumes in the same series, especially Volumes 18 and 19 in which Euler's massive *Scientia navalis seu tractatus de construendis ac dirigendis navibus* is reprinted. The latter two volumes, edited by C. Truesdell, contain no scholarly introduction. The introduction is instead supplied in a 190-page essay by Walter Habicht at the beginning of Volume 21. There Professor Habicht provides detailed analyses of both volumes of the *Scientia navalis* and situates the work in the context of mid-18th-century fluid mechanics. He also makes ample reference to other relevant literature published both in the *Opera omnia* series and elsewhere.

The *Scientia navalis* is the most comprehensive of Euler's works on the construction of ships and the art of navigation. Other publications on the same or related subjects are reprinted in Volume 21. The longest among them is the *Théorie complette de la construction et de la manoeuvre des vaisseaux* (Enestrom 426), published in St. Petersburg in 1773. The others are prize essays on pitch and roll in ships (E415) and on the loading of naval vessels (E27), a study of the theory of resistance as it affects the prow of a vessel (E520), and a description of a device for moving boats upstream (E545). The greater part of E27, although submitted to the Paris Academy by Johann Albrecht Euler, is probably to be ascribed to his father. Professor Habicht provides summaries of these works in his 45-page introduction to Volume 21, which draws useful comparisons between the contents of Volume 21 and the *Scientia navalis*. He devotes

0315-0860/83 $3.00

greatest attention to the *Théorie complette*, which was intended to be an elementary and practical textbook covering the statics of ships, the effect of water resistance and the rudder, and the maneuvering of sailboats.

Euler also turned his analytical talents to other applications of fluid mechanics, especially the resistance of air. Diverse works on this subject are collected in Volume 16. Charles Blanc and Pierre de Haller supplied the introductory essay, which contains a summary of each work together with references to useful secondary literature, particularly J. Ackeret's and C. Truesdell's introductions to other volumes in the series. The range of topics is wide: the action of wind on surfaces, windmills, and kites (A12, E229, E223, A4); calculations regarding balloons and the construction of manometers (E579, E843); hydraulic machines (E248, A2); and blood pressure (E855). Among the works are publications by J. A. Euler, again based largely on his father's work.

Both these volumes, like the rest of the *Opera omnia*, perform a number of services for the modern reader. They unite in handsome volumes separate publications and works that first appeared in scholarly periodicals from Paris to St. Petersburg. In the case of Euler's memoir on the flow of blood through arteries, originally published in incomplete form in the *Opera posthuma* (1862), the full version appears in print for the first time in Volume 16, thanks to the discovery of the remainder of the manuscript in the Archives of the Soviet Academy of Sciences in Leningrad. Obvious typographical errors in the originals are identified, and ambiguous notation is elucidated in the introductions or footnotes. Scholars will appreciate the editors' faithfulness to original orthography and notation; when deemed appropriate, as in Professor Habicht's analysis of the 1761 prize essay in Volume 21, crucial results are recast in modern form in the introductory material.

Not all problems are resolved. For example, as explained in the introduction to Volume 16, an error mars the calculations on the optimal configuration of vanes. But because of the "fragility" of the original physical premise, the editors decided that complete recalculation of Euler's results was not warranted. Indeed, dubious assumptions, especially with regard to resistance, made for a wide gap between practical experience and much 18th-century analysis of fluid mechanics. What makes Volumes 16 and 21 most interesting to the modern reader is the vitality of Eulerian analysis and the diversity of its intended applications.