BOOK REVIEW

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Pressure Vessel Technology

Editors Gengdian Liu and Roy W. Nichols

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Reviewer Nasr M. Ghoniem

Significant progress has been made in recent years on the technology of pressure vessels, which are used in many fields of engineering. This worldwide activity has been motivated by advances in technological areas such as the chemical, petrochemical, aerospace, marine, and nuclear and fossil power industries. In these applications, extremes of temperature, pressure, and aggressive environments are generally encountered. Materials used in such applications must be carefully designed, analyzed, and manufactured. This book represents a collection of 140 papers, which were selected from a larger number of papers submitted for inclusion in the 6th International Conference on Pressure Vessel Technology. The conference was organized by the Chinese Pressure Vessel Institution of the Chinese Mechanical Engineering Society with the cooperation of the Asia-Oceanic Regional Committee and the High Pressure Institute of Japan.

The book is divided into three volumes: Vol. 1, "Design and Analysis"; Vol. 2, "Materials and Fabrication"; and Vol. 3, "The Robert Wylie Memorial Lecture." Several papers are dedicated to the many design aspects of pressure vessel components, such as threaded connections, plastic fracture of components, fatigue design, plastic collapse of hot piping, elevated temperature design of gaskets, heat exchanger component design, and design of composite and wire-wound superhigh-pressure vessels. These papers are particularly important to the continuous updates of international engineering design codes. In this regard, several papers address code design modifications [e.g., the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code and the French Design Code for Nuclear Reactors]. A smaller number of papers are concerned, however, with reviewing the activities of relevant sections of these design codes. An example is the paper presented by S. H. Bush on the ASME Sec. XI activities and future prospects of design directions.

Papers on analysis of structural problems, including fluid/structure interaction, incorporated semianalytical methods (e.g., Fourier series expansion methods) and numerical methods (e.g., vibration problems, flow-induced instabilities in cross flow, thermal stresses, crack mechanics, buckling, large deformation, and elastoplastic analyses). The seismic design of nuclear power plants is addressed by few investigators who use probabilistic and stochastic methods of analysis.

Materials properties and fabrication issues are the foci of some 81 papers in Vol. 2. Fatigue testing techniques for pressure vessels and piping are discussed in several papers. Fatigue crack initiation and propagation characteristics are analyzed in terms of basic steel properties. Aspects of fracture mechanics design of fatigue-loaded structures, particularly at welds, are emphasized in several papers. Problems of high-temperature creep and creep/fatigue interaction are dealt with in the context of testing and design methodologies. Recent developments in manufacturing and fabrication technologies are presented in the areas of heavy-wall pressure vessels, elbowless piping produced by induction bending, welding technologies, and remote-controlled handling devices.

The concept of in-service inspection of reactor pressure vessels was established more than a decade ago with important implications on the lifetime assessment, reliability, and maintenance of operating pressure vessels. Ultrasonic nondestructive evaluation techniques are now widely used. New developments in this area include successful applications for continued operations, defect imaging, echo tomography, and examination of welds. Reliability studies of pressure vessels take two distinct methodologies. One approach is to improve the stress analysis models for pressure vessels and piping (e.g., by using three-dimensional finite element analysis), while the other approach emphasizes probabilistic methods. Material properties are assigned probability distribution functions in the second approach, and crack growth rates are integrated up to failure. Thus, failure probabilities at various loading conditions can be predicted.

The third volume is dedicated to the honor of Robert D. Wylie. The president of the High Pressure Institute of Japan, T. Kanazawa, gave the third memorial lecture, in which he reviewed the current practices and future trends in pressure vessel technology. Emphasis was on ferrous materials,

fabrication techniques, life expectancy, and structural integrity. Perspectives on the internationalization of engineering and on pressure vessel technologies in Europe and China are included in this volume. In addition, conclusions and discussions of a special panel on the seismic design of pressure vessels and piping aim at clarifying the complicated aspects of seismic loading and design.

The conference covered a wide range of topics in an important area of mechanical and nuclear engineering. The depth and breadth of many papers point to the enthusiasm of participants from many parts of the world with varying engineering backgrounds. The editors are to be complimented for a job well done in the classification of topics and in the general organization of the book.

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