

## Special Issue of the Naval Engineers Journal on Reliability-Based Ship Structural Design

In a recent special issue for Spring 2002, the Naval Engineers Journal (NEJ) of the American Society of Naval Engineers (ASNE) provides a collection of papers featuring reliability-based load and resistance factor design (LRFD) guidelines and rules for surface ship structures. The collection of the papers presented in this special issue provides an insight into advancing the state-of-the-art of Navy structural design by rational and purposeful treatment of uncertainty. For many years, ship structural design has been accomplished under conditions of uncertainty about materials, loads, structural behavior, and failure modes. To deal with this uncertainty, structural engineers traditionally use factors of safety (FS) in the design of a ship structural system to ensure its proper functioning during its lifetime. However, because the use of traditional safety factors does not properly account for this uncertainty in the design, modern design codes are now based on reliability-based load and resistance factors (also called partial safety factors), which take into account the variability in both the strength and the load affects, and hence, provide for more rational and possibly cost-effective design.



The papers provided in this special issue of the NEJ summarize the last decade of work in reliability-based design methods and provide the basis for future development in this area of design by the Center for Technology and Systems Management (CTSM) in collaboration with Carderock Division of Naval Surface Warfare Center (NSWC) and Naval Sea System Command (NAVSEA) based on funding from the Office of Naval Research (ONR). The papers also form

the basis for reliability-based load and resistance factor design (LRFD) guidelines and rules for surface ship structures, and represent a milestone towards transforming the design practice from working stress design (WSD) to reliability-based limit state LRFD design. The authors of these papers provide a window on the future of structural design of surface ships. Key primary authors and co-authors of these papers include Dr. Bilal M. Ayyub and Dr. Ibrahim A. Assakkaf of the Center of Technology and Systems Management (CTSM). With extensive background in uncertainty modeling, risk analysis, and reliability-based design for ship structures, the CTSM has been engaged in a number of research projects funded by the U.S. Navy, University of New Orleans (UNO), and other government organizations to develop Load and Resistance Factor Design (LRFD) for ship structures.

The technical papers that were published in the Spring Issue of the Naval Engineers Journal include the following titles and authors:

- (1) **“Methodology for Developing Reliability-Based Load and Resistance Factor Design (LRFD) Guidelines for Ship Structures,”** Bilal M. Ayyub, Ibrahim A. Assakkaf, Jeffrey E. Beach, William M. Melton, Natale Nappi, Jr., and Judy A. Conley.
- (2) **“Reliability-Based Load and Resistance Factor Design (LRFD) Guidelines for Hull Girder Bending,”** Bilal M. Ayyub, Ibrahim A. Assakkaf, Jerome P. Sikora, John C. Adamchak, Khaled Atua, William Melton, and Paul E. Hess, III.
- (3) **“Reliability-Based Load and Resistance Factor Design (LRFD) Guidelines for Unstiffened Panels of Ship Structures,”** Ibrahim A. Assakkaf, Bilal M. Ayyub, Paul E. Hess, III, and David E. Knight.
- (4) **“Reliability-Based Load and Resistance Factor Design (LRFD) Guidelines for Stiffened Panels and Grillages of Ship Structures,”** Ibrahim A. Assakkaf, Bilal M. Ayyub, Paul E. Hess, III, and Khaled Atua.
- (5) **“Reliability-Based Design Guidelines for Fatigue of Ship Structures,”** Bilal M. Ayyub, Ibrahim A. Assakkaf, David P. Kihl, and Michael W. Sieve.
- (6) **“Uncertainties in Material Strength, Geometric, and Load Variables,”** Paul E. Hess, Daniel Bruchman, Ibrahim A. Assakkaf, and Bilal M. Ayyub.



(7) **“Assessment of Cumulative Lifetime Seaway Loads for Ships,”** by Jerome P. Sikora, Robert W. Michaelson, and Bilal M. Ayyub.

(8) **“Risk Analysis and Management for Marine Systems,”** Bilal M. Ayyub, Jeffrey E. Beach, Shahram Sarkani, and Ibrahim A. Assakkaf.

For additional information on these papers and related projects, please contact Dr. Bilal M. Ayyub at 301-405-1956. To order a copy of this special issue of the NEJ (Vol. 114, No. 2), please contact ASNE at 1452 Duke Street, Alexandria, VA 22314-3458, 703-836-6727 (Tel), 703-836-7491 (Fax), [asnehq@navalengineers.org](mailto:asnehq@navalengineers.org) (E-Mail), [www.navalengineers.org](http://www.navalengineers.org) (URL).

