25th Georg Weinblum Memorial Lecture
Monday, March 24, 2003 - 10:00 am
Lecture Room
The National Academies
500 Fifth Street N.W.
Washington, DC 20001

"Modeling Viscosity Effects in Surface-Wave Problems"

Professor Ronald W. Yeung
University of California at Berkeley

Ronald W. Yeung, born 1945 in what was then British Hong Kong, grew up in a home overlooking Victoria Harbor. His interests in ships and the sea led him to mechanical engineering and naval architecture at the University of California at Berkeley, where he received a B.S. in 1968 and was the University Medalist of his graduating class. He completed his M.S. (1970) and doctorate (1973) under Professor John V. Wehausen, the first Weinblum lecturer. Between his graduate degrees, he worked as a naval architect in the designing of several types of ships at the Advanced Marine Technology Division of Litton Ship Systems, in Culver City, California.

His first scientific work, on sinkage and trim of ships, was published in the 1972 Special Edition of the *Journal of Ship Research* in honor of the 75th birthday of Georg Weinblum. From 1973 to 1982, he was assistant and, later, associate professor in the Department of Ocean Engineering, Massachusetts Institute of Technology. In 1981, he visited the Department of Applied Mathematics at the University of Adelaide, Australia, as a Fulbright-Hayes Senior Scholar. Since 1982, he has been professor of hydromechanics and ocean engineering at the University of California at Berkeley, currently holding the rank of distinguished professor.

In 1988, he was recipient of the Alexander von Humboldt Prize (Distinguished U.S. Scientist Award) and visited, as a Humboldt Professor, the Institut für Schiffbau at Hamburg (1988) and the Gerhard-Mercator University of Duisburg (1998). He was also a visiting professor at the Research Institute of Applied Mechanics at Kyushu University, Fukuoka, Japan, in 1998. He received the Best-Paper Award of the 1990 ASME–Offshore Mechanics and Arctic Engineering (OMAE) Conference at Stavanger and was research advisor of seven other student papers that won national awards. He was elected a fellow of the Society of Naval Architects and Marine Engineers in 1998.

Professor Yeung has made important contributions to solutions of a broad range of marine problems, with topics encompassing computational methods, ship-to-ship interaction theory, wave-body interaction, channel-wall effects, unsteady bow waves, shell-function methodology, wave-vorticity interaction, two-layer wavy flow, and hydroelastic waves. Among these, the now-popular Rankine-source, free-surface, integral-equation formulation is rooted in his works in the 1970s. In his lecture "Modeling Viscosity Effects in Surface-Wave Problems," Professor Yeung will present a plenary view of his recent research, which has led to a capability for including the effects of fluid viscosity in free-surface flows. Application of this latest method to investigate vortex-induced vibration and roll-motion damping will be illustrated.

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Abstract

A plenary view is given on the methodologies developed at Berkeley for treating the complex effects of viscosity in problems with free surfaces. These methods include a vorticity-diffusion theory developed for radiation-force prediction, a boundary-fitted Navier-Stokes solver for studying bow-wave mechanics, and a more recently developed grid-free free-surface vortex method with the best potential of modeling the unsteady, coupled motion of fluid and bodies of arbitrary shapes. This latest development provides a capability to efficiently merge the elegant inviscid boundary-integral formulation with a near-body vortical solution and, in particular, for motion in an incident-wave environment. The application of this latest method to investigate vortex-induced vibration and roll-motion damping is discussed.