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"Obliquely Incident Solitary Wave along a Vertical Wall"

by

Prof. HARRY H. YEH

The Miles Lowell and Margaret Watt Edwards Distinguished Chair in Engineering,
Oregon State University

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Abstract

Reflection of an obliquely incident solitary wave along a vertical wall may create the formation of the Mach stem. The previous laboratory and numerical experiments failed to validate the Mach reflection phenomenon predicted by Miles [1]. Here we show that the discrepancy is primarily originated from the assumption of small incident wave angle. Ex- pressing the incident solitary wave with the quasi-two-dimensional Kadomtsev-Petviashvili (KP) theory, Miles's theory can be extended to the higher-order correction for the incident wave angle. With this revision, the laboratory

and numerical results are now found to be in better agreement with the theory. Our results demonstrate that the evolution of stem- wave amplification is in good agreement with the numerical prediction of the KP theory. The asymptotic characteristics are also in agreement with Miles's theory except those in the neighborhood of the transition between the Mach reflection and the regular reflection. The- oretically predicted maximum four-fold amplification of the stem wave cannot be realized in the experiments: the measured amplification is 2.9 instead. The maximum amplification factor at the wall has significant engineering consequences in designing coastal structures. The present study is the first to sensibly analyze validation of the theory. In addition, the KP solutions for interacting two line-solitons will be discussed and compared with our laboratory data.

Biography

Prof. Harry H. YEH is the Miles Lowell and Margaret Watt Edwards Distinguished Chair in Engineering at Oregon State University. He also holds the position of Adjunct Professor in College of Oceanic and Atmospheric Sciences. He received an AB degree in Economics from Keio Gijuku University (Japan); BS and MS in Agricultural Engineering from Washington State University; and a PhD in Civil Engineering from University of California, Berkely.

Firstly worked as a Hydraulic Engineer for Bechtel Inc. in the late 70's and early 80's, and awarded the Award of Merit in 1979, Prof. YEH primarily analyzed hydrodynamics problems involved in electric power plants. He then began his academic career in 1983 at the University of Washington, and joined the faculty of School of Civil and Construction Engineering at Oregon State University in 2003. Prof. YEH was also visiting scholar in the Disaster Prevention Research Institute in Kyoto University, Stanford University and Cornell University.

Prof. YEH was awarded the Irving and Lucille Smith Scholarship in 1979 and the Japanese Government Research Award for Foreign Specialist by the Prime Minister's Office of Japan in 1998. He was recognized in fellowships such as the Japan Society for the Promotion of Science (JSPS) Short-term Invitation Fellowship for Research in Japan in 1999 and 2008 and the Disaster Prevention Research Institute (DPRI) Visiting Senior Professor Fellowship in 1997.

As a Registered Civil Engineer in the State of California in the United States, Prof. YEH also affiliated with several professional associations such as the American Society of Civil Engineers, the American Geophysical Union, the Earthquake Engineering Research Institute and the Japan Association for Wind Engineering.

In the field of education and science, Prof. YEH devotes great interests in the field of hydrodynamics of tsunamis focusing on controlled laboratory experiments and theoretical development of nonlinear long-wave theory in close collaboration with applied mathematicians. He also works on the development of tensor-field visualization, as well as the development of IT tools for tsunami hazards mitigation, in topics of gravity currents, lake hydrodynamics, wind turbulence, vorticity dynamics at the fluid-fluid interface, structural control, and tsunami evacuation simulations.

Apart from teaching and conducting academic research, Prof. YEH has been the editor of the Journal of Disaster Research for Fuji Technology Press Ltd., since 2006. He has been working on a substantial number of academic works, some of his significant publications such as "Laboratory study of the cross-shore flow structure in the surf and swash zones" and "On the Mach reflection of a solitary wave – revisited." in 2011; "Tsunami Impacts on Coastlines" in 2009; "Tsunami Runup and Drawdown on a Plane Beach" and "Tsunami Scour around a Cylinder: an Effective Stress Approach" in 2003.

Recently, Prof. YEH also joined the ATC-64 Project Management Committee for Development of Design and Construction Guidance for Special Facilities for Vertical Evacuation from Tsunami for the Federal Emergency Management Agency (FEMA P646), and participated in several reconnaissance field surveys for tsunamis – from the 1992 Nicaraguan event to most recent Japanese Tsunamis. He has organized a number of interdisciplinary workshops for long–wave modeling, measurements, bathymetry and topography data, seafloor deformation, and tsunami scenario simulations, as well as workshops focusing on the design and use of the tsunami facility.

ALL ARE WELCOME!