THE BEHAVIOR OF SUBMERGED, MULTIPLE BODIES IN EARTHQUAKES

by

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Report to

NOAA, Office of Sea Grant
Department of Commerce, Washington, D.C.
and
The State Resources Agency of California

Report No. UCB/EERC-82/16
Earthquake Engineering Research Center
and
Hydraulic Engineering Laboratory
University of California
Berkeley, California

September 1982

ACKNOWLEDGEMENTS

This work is a result of research sponsored by NOAA, Office of Sea Grant, Department of Commerce under Projects R/OT-1-WGL-SD-09/82 and E/G-2-WIEGEL-09/82, and by the State Resources Agency of California. The author sincerely appreciates their support.

This work also constitutes the author's doctoral dissertation submitted to the University of California, Berkeley. The dissertation committee consisted of Professors William C. Webster (Chairman), Joseph Penzien, Robert L. Wiegel and Alaa E. Mansour. The author is grateful to the professors in the committee for providing advices and invaluable suggestions.

Special thanks are extended to Professor William C. Webster who served as dissertation committee chairman, to Professor Joseph Penzien who served as academic advisor, and to Professor Robert L. Wiegel who served as program coordinator throughout the author's doctoral program.

The author is also thankful to Mr. G. R. Ansari for providing discussions and suggestions.

ABSTRACT

In order to investigate the nature of hydrodynamic interaction between two (or more) cylinders subjected to earthquake ground motion, a numerical analysis for determining the hydrodynamic forces and the corresponding structural responses on a non-axisymmetrical offshore structure is presented.

With the assumption of potential flow theory, the finite element method is developed to solve the boundary value problem in fluid domain. Moreover, the principle of symmetry and antisymmetry is applied to the problem such that the fluid domain can be reduced to one half. A localized finite element method utilizing eigenfunction expansions is also outlined in detail. If the cylinders have uniform cross sections, the three-dimensional problem can be reduced to a two-dimensional one and the computation becomes much more efficient. A computer program is developed to analyze the hydrodynamic forces and the structural responses according to the above mentioned analysis procedure. Examples are presented to illustrate the points discussed. Comparing with the experiments of a physical model on an earthquake simulator, the results are generally in agreement.

From the results of the research, we arrive at the conclusion that the hydrodynamic interaction is relevant as the cylinders are closer. Also, this phenomenon depends on the characteristics of structures, water depth, the excitation frequency, the amplitude of ground motion, and the direction of excitation.