

ABSTRACT

An Investigation into the Wave Energy Potential of the Caribbean and the Application of Symmetrical Heaving Body Recovery Systems

Anil Hemant Singh

Ocean wave energy represents a vast untapped resource. Exploitation of this resource requires its characterization by estimating the available energy of the waves and a suitable means of extracting the energy. In this thesis, wave power estimates and direction coefficients were calculated for the Caribbean based on available data and an investigation into the feasibility of the use of symmetrical heaving bodies limited to circular, elliptical and rectangular cylinders is presented.

The wave power and direction coefficients are evaluated by utilizing the linearized theory of the Ocean Spectral Model. In particular, the idealized Bretschneider point spectra suitable modified by the cosine-squared spreading function is used. The evaluation of the heaving bodies was undertaken by utilizing the existing linear model for predicting the heaving body tuning frequency and efficiency characteristic. The Multipole method is used to evaluate the hydrodynamic coefficients of the various cylinders.

The seasonal variation of wave power in the Caribbean is found to be as follows: 12.3 kW/m for the September-November season, 27.8 kW/m for both the March-May and June-August seasons and 35.7 kW/m for the December-February

season. This resource can be characterized as a low to medium energy density resource that is definitely suitable for exploitation. The Caribbean region can be represented by an average direction coefficient that was found to be 0.42. This has a significant implication for directionally sensitive devices such as heaving bodies. It shows that these bodies must be properly aligned with the predominant wave direction. Of the three geometries considered, the elliptical cylinders were found to be most suited for the wave climate of the Caribbean. Symmetrical heaving body wave energy devices, in general, can definitely present themselves as a possible future alternative energy source in the Caribbean.

Professor of the West Indies

Professor E. Ursell (Retired)

Tutorial Assistance-Multipole Method

Department of Mathematics

University of Manchester

Dr. W. R. Porter (Retired)

Tutorial Assistance-Multipole Method

Society of Naval Architects and Marine Engineers