

THREE-DIMENSIONAL ANALYSIS OF MOORED CYLINDERS
USED AS BREAKWATERS

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(ABSTRACT)

For oblique and normal water waves at various frequencies, the use of moored cylinders as breakwaters is considered numerically using linear three-dimensional analysis. The breakwater can be used by itself for protection of small structures or as a series of cylinders to protect a harbor, shoreline, or moored vessel from the destructive energy associated with incident water waves. The breakwater is completely submerged below the free surface and is attached to the ocean floor with six symmetrically configured mooring lines. The cylinder is filled with air and the mooring lines remain taut during the structure's motion. Six degrees of freedom describe the motion of the breakwater and additional degrees of freedom are introduced as the cables are modeled with the use of lumped masses connected with springs. The fluid is assumed to be inviscid and incompressible, so that the velocity field can be written as the gradient of the velocity potential. A boundary integral method is used to solve the integral equations that define the external fluid flow. Free vibrations of the cylinder in both air and water are considered and "dry" and "wet" natural frequencies are computed. Motions caused by water waves are studied to establish the effect of certain parameters on the effectiveness of the breakwater. The transmission coefficient is shown to be somewhat misleading when compared to plots that show the spatial variation of the wave amplitude.

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