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Normal modes of a rectangular tank with corrugated bottom JIE YU, Civil, Construction and Environmental Engineering, North Carolina State University, LOUIS HOWARD, Department of Mathematics, MIT — We study some effects of regular bottom corrugations on water waves in a long rectangular tank with vertical end walls and open top. In particular, we consider motions which are normal modes of oscillation in such a tank. Attention is focused on the modes whose internodal spacing, in the absence of corrugations, would be near the wavelength of the corrugations. In these cases, the perturbation of the eigenfunctions (though not of their frequencies) can be significant, e.g. the amplitude of the eigenfunction can be greater by a factor of ten or more near one end of the tank than at the other end. This is due to a cooperative effect of the corrugations, called Bragg resonance. We first study these effects using an asymptotic theory, which assumes that the bottom corrugations are of small amplitude and that the motions are slowly-varying everywhere. We then present an exact theory, utilizing continued fractions. This allows us to deal with the rapidly varying components of the flow. The exact theory confirms the essential correctness of the asymptotic results for the slowly varying aspects of the motions. The rapidly varying parts (evanescent waves) are, however, needed to accurately satisfy the true boundary conditions, hence of importance to the flow near the end walls.

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