PIMS APPLIED MATHEMATICS SEMINAR SERIES

Pacific Institute *for the* Mathematical Sciences

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Friday, February 10, 2012
3:30 pm, Arts 134
University of Saskatchewan

WATER WAVES OVER A ROUGH BOTTOM IN THE SHALLOW WATER REGIME

This is a study of the Euler equations for free surface water waves in the case of varying bathymetry, considering the problem in the shallow water scaling regime. In the case of rapidly varying periodic bottom, this is a problem of homogenization theory. In this setting, we derive a new model system of equations, consisting of the classical shallow water equations coupled with nonlocal evolution equations for a periodic corrector term. We also exhibit a new resonance phenomenon between surface waves and a periodic bottom. This resonance, which gives rise to secular growth of surface wave patterns, can be viewed as a nonlinear generalization of the classical Bragg resonance. We justify the derivation of the model with a rigorous mathematical analysis of the scaling limit and the resulting error terms. The principal issue is that the shallow water limit and the homogenization process must be performed simultaneously. Our model equations and the error analysis are valid for both the two- and the three-dimensional physical problems.

This is a joint work with Walter Craig and David Lannes.

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