Reflection from porous bottom elevations

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We consider an incident free surface wave which is reflected from one single or a series of bottom elevations. The problem is 2-D and assumed to be linear. The solution of the problem is obtained by a boundary element method.

First is considered a single elliptic impenetrable boundary elevation for various values of the parameters. Thereafter the boundary elevation is assumed to be a porous medium. In the region where Darcy's law is valid, we find only small effect of the porous medium. It seems however reasonable that a thin porous shell of the same form (with water on both sides) would give a larger effect. This is shown to be true. We find for example for a bottom elevation of height 2/5 h (h the depth of the fluid layer) and length 8/5 h and incident wave length 6 h, that the amplitude of the transmitted wave, T, is given by $T^2 = 0,75$ for the porous shell whereas for the impenetrable case T is very close to one, given by $T^2 = 0,97$.

Especially emphasis is laid on Bragg reflection, i.e reflection from a periodic bottom corrugation. It is known that for a sinusoidal bottom corrugation consisting of many periodes total reflection is obtained for an incident wave length about two times the wave length of the bottom corrugation. The incident wave spectrum corresponding to large reflection is, however, very narrow. It is therefore of interest to examine whether a periodic bottom corrugation of a porous medium or a porous shell, will lead to that this incident wave spectrum is substantially broadened.

We find that the spectrum has become somewhat broader due to the porous effects. The porosity has also effect on the number of periods of the bottom corrugation necessary to obtain almost total reflection. We also find that, especially for the porous shell, both the transmitted and reflected wave amplitudes are considerably lowered compared to the impenetrable case for a large region of incident wave lengths.