Omnidirectional reflection for liquid surface waves propagating over a bottom with 1D periodic undulations

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It was known that there does not exist a complete band gap (along all directions) in infinite 1D photonic crystals, e.g., two dielectric layers stacking alternatingly. However, it was shown recently that a finite 1D photonic crystal can totally reflect incident light over a certain frequency range at all angles, i.e., omnidirectional total reflection [1-3]. The central idea resides in that if there are no propagating modes that can couple an incident wave of any angle, omnidirectional total reflection can occur.

In this work, we show theoretically the analog of omnidirectional total reflection in liquid surface waves propagating over a bottom with a 1D periodic undulation. We found that omnidirectional total reflection can exist in this system if the undulatory parameters are properly chosen. A general criterion that enables omnidirectional total reflection was proposed. The existence of omnidirectional total reflection for liquid surface waves propagating over a bottom with 1D periodic undulations may manifest potential applications.

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