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Wave resonances in the water closed channel of variable depth with moving boundaries

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The structure of the resonant modes in the water channel with moving boundaries is studied in the framework of the one-dimensional linear shallow-water theory. The bottom profile and channel width are chosen having the special shapes allowed the existence of travelling waves with no inner reflection. It is shown that eigenmodes (seisches) are expressed through the Chebyshev polynomials of the second kind. Some properties of the eigenmodes are analyzed. In particular, eigenmodes are described for the following configurations of channel: 1) constant width, 2) constant depth, 3) self-consistent channel of variable width and depth. They can be expressed in the parametric form. Singularities on the moving boundaries are specially investigated demonstrating the features of wave runup on the coast. In conclusion, the physical interpretation and the feasibility of the obtained solutions are discussed.

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