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Synchronous Sloshing in a Free Container ANDRZEJ HERCZYNSKI, Boston College, PATRICK WEIDMAN, University of Colorado, Boulder — A standing wave in a container partially filled with liquid and free to move along one horizontal axis is analyzed. Interaction of the sloshing liquid with the container drives the acceleration of the vessel, which oscillates back-and-forth, out-of-phase with the liquid oscillations. Linearized shallow water theory is employed to obtain lowest-mode frequencies for rectangular and cylindrical containers. Validity of the results require $h/\lambda << 1$ where h is the fluid depth and λ is the sloshing wavelength, and $\eta_o/h << 1$ where η_o is the wave amplitude. Experiments using containers with water, supported on a low-friction cart constrained to move in one dimension, reveal excellent agreement with theory up to a certain liquid depth corresponding to the shallow-water limit. Beyond that critical depth, the observed frequencies of oscillation are lower than linear predictions and thus full potential theory is required.

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