

國立中山大學應用數學系

學術演講

講者：陳志漢 (Wake Forest University)

講題：An isoperimetric sloshing problem in a shallow container with surface tension

時間：2024/03/04 (Monday) 10:10~11:00

地點：理 SC 4009-0 教室 (線上與實體同步進行)

Google Meet Link: <https://meet.google.com/evg-ukyx-opd>

Abstract

In 1965, B. A. Troesch solved the following isoperimetric sloshing problem: Among all symmetric shallow canals with a fixed cross-sectional area or among all shallow radially symmetric containers with a fixed volume, the container with a parabolic cross-section maximises the first nonzero sloshing frequency. We extend Troesch's result in two ways: (i) we include surface tension effects on the fluid free surface with a pinned contact line, and (ii) we consider sinusoidal travelling waves with wavenumber along the canal. Exploiting the symmetry of containers and the shallow water theory, we transform the isoperimetric sloshing problem to a one-dimensional eigenvalue optimisation problem for a generalised Sturm-Liouville system. Using a variational argument, we derive a sufficient first-order optimality condition and explicitly solve for the maximising container shapes. Our results reveal the following: (i) except for sinusoidal travelling waves for canals, the maximising container shapes are no longer convex and flattened near the contact points, and (ii) the squared maximal sloshing frequency increases considerably as surface tension increases.

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