

Steady water waves with localized vorticity

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We consider the fluid free surface problem -- the free boundary problem of the Euler equation with gravity and surface tension -- and construct finite energy small amplitude steady wave solutions with vorticity based on a bifurcation approach. Unlike those perturbed from shear flows, the vorticity of these solutions are highly concentrated, including traveling waves with compactly supported vorticity and smooth stationary waves with rapidly decaying vorticity.