# Uniqueness and stability results on steady water waves with vorticity

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**Abstract**

We consider the two-dimensional nonlinear problem describing steady gravity water waves with vorticity in a channel of a finite depth. The water motion is assumed to be unidirectional and the surface tension is neglected. It is well known that among small-amplitude waves only Stokes and Solitary waves exist provided the Bernoulli's constant is close to its critical value. We complete this result by proving that all near-critical waves are necessary small. Furthermore, we prove a stability estimate that imply uniqueness for small-amplitude waves with a prescribed Cauchy data of the profile at some point and provide a parametrization by the amplitude for the family of waves with near-critical values of the Bernoulli's constant. Using similar methods, we study solitary type waves for arbitrary Bernoulli's constants and prove that they are necessary supported by sub-critical shear flows. In particularly, this means that there are no waves that oscillate and decay at the same time.

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