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Graduation Term:SS 2017
Department:Mathematics
Degree:PhD
Title:Large-amplitude solitary water waves with discontinuous vorticity

Water waves are phenomena that impact many aspects of life on Earth. From minute effects on climate to tsunamis, water waves are ubiquitous---extending even beyond what is observable to the human eye. As a mathematical problem, water waves pose a wide range of challenges; the governing equations for a fluid in motion were initially developed by Euler in the 1750s and, due to the progress made by household names such as Cauchy, Laplace, Lagrange, Poisson, and Stokes, the study of water waves has contributed to the historical development of mathematics as a whole. Euler's equations continue to be the basis for models used by present day mathematicians and engineers, but the high nonlinearity of the equations and the difficulties posed by this classical free boundary problem (when the exact shape of the fluid domain is unknown) inspire the development of new methodologies and sharper computational approaches.

Steady water waves are waves which, when viewed in a moving frame of reference, appear stationary. Several centuries after Euler pioneered the governing equations, there was a surge of work on steady water waves which was sustained throughout the turn of the millennium. Even still, it continues to be a growing field of study.

As such, steady water waves have yet to be explored in a variety of physically significant regimes. A few of the fundamental problems to consider are: the existence and qualitative properties of solutions; the stability of solutions; the effects of vorticity, density, and surface tension; the distribution of pressure throughout the fluid; and the reconstruction of surface waves from pressure data at the ocean bed.

In this thesis, we establish the existence and qualitative properties of solitary wave solutions with constant density and discontinuous vorticity. The first part of my work is devoted to establishing the existence and qualitative properties of small-amplitude solitary water waves with discontinuous vorticity; in the second part, we continue the small-amplitude waves into the large-amplitude regime using global bifurcation techniques.