FREE SURFACE WAVES IN EQUILIBRIUM WITH A VORTEX

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Abstract. Finite amplitude solitary waves of uniform depth which interact with a stationary point vortex are considered. Waves both with and without a submerged obstacle are computed. The method of solution is collocation of Bernoulli's equation at a finite number of points on the free surface coupled with equations for equilibrium of a point vortex. The stream function and vortex location are found by computing a conformal map of the flow domain to an infinite strip. For a given obstacle the solutions are parametrized with respect to Froude number and vortex circulation. When no obstacle is present there are two families of solutions, in one of which the amplitude of the wave increases by increasing the circulation, while in the other amplitude increases by decreasing the circulation. Beyond a certain critical Froude number the maximum amplitude wave has a sharp crest with an angle of 120 degrees. Similar behavior is observed for the flow past a submerged obstacle except that there is a critical Froude number below which there is no solution at all.