

Vera Hur

Stokes waves in constant vorticity flows

Abstract: In the 1800s, Stokes made significant contributions to our understanding of periodic waves on the surface of water, under the influence of gravity, propagating long distances at a practically constant velocity without changing shape. He observed that in an irrotational flow, crests become sharper and troughs flatter as the amplitude increases, and that the so-called extreme wave is characterized by a 120 degree angle at the crest. The irrotational flow assumption can be justified in many situations and is useful for rigorous analysis and numerical computation. But rotational effects are important in many other situations.

I will discuss recent progress in constant vorticity flows, which builds on the problem's reformulation through conformal mapping. Our numerical results improve upon those from the 1980s by Simmen and Saffman, Teles da Silva and Peregrine, revealing a host of new solutions, such as Crapper's exact solution (even though there is no surface tension) and a fluid disk in rigid body rotation. I will also examine the effects of vorticity on the extreme wave, particularly the maximum slope for an almost extreme wave.