

The Stokes waves on ideal fluid: modulational instability and wave breaking

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The long-standing problem of stability of surface waves on 2D fluid is solved in conformal variables for Stokes up to nearly extreme steepness. The stability spectrum of Stokes waves exhibits recurrent transitions, multiple modulation, or Benjamin-Feir instability branches. We show that all Stokes waves are, in fact, unstable, but the nature of these instabilities varies — in some cases it leads directly to wave-breaking, and, in others, to modulational disturbance and appearance of rogue waves in the ocean swell. We discuss the profound change in the numerical approach that allowed us to consider nearly extreme Stokes waves.