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Traveling waves in the Camassa-Holm equations: their stability and instability

The Camassa–Holm equation in one spatial dimension admits traveling solitary and periodic waves with the smooth, peaked, and cusped profiles. I will overview recent results on the stability analysis of the traveling solitary waves in the Camassa–Holm equation and its extensions, the b-family of the Camassa–Holm equations. In particular, we proved the spectral and orbital stability of traveling waves with the smooth profiles. At the same time, we showed that the traveling waves with the peaked profile are linearly and nonlinearly unstable in $H^1 \cap W^{1,\infty}$ despite their orbital stability in H^1. More recently, we proved the transverse stability of one-dimensional solitary waves with the smooth profiles in the two-dimensional generalization of the Camassa–Holm equation.