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A general family of multi-peakon equations

A general family of peakon equations is considered, involving two arbitrary functions of the wave amplitude and the wave gradient. This family contains all of the known breaking wave equations, including the integrable ones: Camassa-Holm equation, Degasperis-Procesi equation, Novikov equation, and FORQ/modified Camassa-Holm equation. All of the equations in the general family are shown to possess weak solutions given by multi-peakons. The most general subfamily of these equations that possess the Hamiltonian structure shared by the Camassa-Holm and FORQ/modified Camassa-Holm equations is derived. As examples, one-parameter families of generalized CH and FORQ/modified Camassa-Holm equations with multi-peakon solutions and a Hamiltonian structure are presented. Wave breaking criteria are outlined for these equations.