Nonlinear stability of 2-solitons of the sine-Gordon equation in the energy space

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In this article we prove that 2-soliton solutions of the sine-Gordon equation (SG) are orbitally stable in the natural energy space of the problem H1×L2. The solutions that we study are the 2-kink, kink?antikink and breather of SG. In order to prove this result, we will use Bäcklund transformations implemented by the Implicit Function Theorem. These transformations will allow us to reduce the stability of the three solutions to the case of the vacuum solution, in the spirit of previous results by Alejo and the first author [3], which was done for the case of the scalar modified Korteweg?de Vries equation. However, we will see that SG presents several difficulties because of its vector valued character. Our results improve those in [5], and give the first rigorous proof of the nonlinear stability in the energy space of the SG 2-solitons.