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Bingying Lu* (bylu@umich.edu), 530 Church St, Ann Arbor, MI 48109, and **Peter D Miller** (millerpd@umich.edu), 530 Church St, Ann Arbor, MI 48109. *The semi-classical sine-Gordon equation, universality at the gradient catastrophe and Painlevé-I equation.*

We consider a class of solutions with pure impulse initial data below critical value such that within small time only librational-type waves are generated and the solutions should decay when $|x| \rightarrow \infty$. In a neighbourhood of a certain gradient catastrophe point that contains both modulated plane waves and localized structures, the asymptotic behaviour of the solutions can be universally described by analyzing a Riemann-Hilbert problem related to Painlevé I equation Tritronquée solutions. It is a well-known fact that the solution to Painlevé equations have poles. In fact we show the locations of the poles are directly linked to where the “spikes” happen. In suitable scaling limit, we are able describe the first correction of the solution (compared to before breaking happens) using Painlevé I Tritronquée solution away from the ”spikes”, and then modify the Riemann-Hilbert problem to describe the ”spike” shapes. Notice that this result is universal in the sense that the local asymptotics is not sensitive to the initial condition as long as it falls into a large class. Our technique is the Deift-Zhou steepest descent method related to an approach of Bertola and Tovbis to universality for the focusing nonlinear Schrödinger equation. (Received August 21, 2018)