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A numerical study on the two-dimensional discrete sine-Gordon equation

It is known that the continuous two-dimensional sine-Gordon equation does not support radial symmetric solutions. Radial initial conditions collapse in finite time. We study numerically the discrete version of this problem, and we obtain radial symmetric solutions that do not collapse. We show using the modulation theory that the collapse is prevented by the Peierls–Nabarro potential generated by the discreteness of the problem. It is also shown that there is a threshold of radial velocities above which the Peierls–Nabarro potential is not enough to stop the collapse. The modulation theory is shown to compare favorably with the numerical solution.