Solitary waves in the Burridge-Knopoff model

The Burridge-Knopoff model is a lattice differential equation describing a chain of blocks connected by springs and pulled over a surface. This model incorporates a nonlinear velocity-dependent friction force between the blocks and the fixed surface. For some classes of non-monotonic friction forces, this system displays a large response to perturbations above a threshold, which is characteristic of excitable dynamics. In some parameter regimes, this response corresponds to the propagation of a solitary wave. We introduce a simplified piecewise linear friction law (reminiscent of the McKean nonlinearity in spiking neuron models) which allows us to prove the existence of large amplitude solitary waves and study their qualitative properties.