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Title: An efficient numerical scheme for computing weakly to strongly interacting multi-fronts/pulses

Abstract:

We develop an efficient and robust numerical scheme to compute multi-fronts/pulses in one-dimensional Real Ginzburg-Landau and Complex Ginzburg-Landau equations that range from well-separated to strongly interacting and colliding. The scheme is based on the global centre-manifold reduction where one considers an initial sum of fronts/pulses plus a remainder function (not necessarily small) and applying a suitable projection based on the neutral Eigenmodes of each front. Such a scheme efficiently captures the weakly interacting tails of the fronts. Furthermore, as the fronts become strongly interacting, we show how they may be added to the remainder function to accurately compute through collisions. We then present results of our numerical scheme applied to various Real Ginzburg Landau equations where we observe colliding kinks, travelling kinks and kinks converging to bound states and in Complex Ginzburg-Landau where one can observe periodic pulse interaction. Finally, we discuss how this numerical scheme can be extended to general PDE systems and other multi-localised structures.