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Computing the Evans function via solving a linear boundary value ODE COLIN WAHL, University of Wisconsin-Madison, ROSE NGUYEN, The University of Texas at Austin, NATHANIEL VENTURA, SUNY-Binghamton, BLAKE BARKER, BJORN SANDSTEDE, Brown University — Determining the stability of traveling wave solutions to partial differential equations can oftentimes be computationally intensive but of great importance to understanding the effects of perturbations on the physical systems (chemical reactions, hydrodynamics, etc.) they model. For waves in one spatial dimension, one may linearize around the wave and form an Evans function - an analytic Wronskian-like function which has zeros that correspond in multiplicity to the eigenvalues of the linearized system. If eigenvalues with a positive real part do not exist, the traveling wave will be stable. Two methods exist for calculating the Evans function numerically: the exterior-product method and the method of continuous orthogonalization. The first is numerically expensive, and the second reformulates the originally linear system as a nonlinear system. We develop a new algorithm for computing the Evans function through appropriate linear boundary-value problems. This algorithm is cheaper than the previous methods, and we prove that it preserves analyticity of the Evans function. We also provide error estimates and implement it on some classical one- and two-dimensional systems, one being the Swift-Hohenberg equation in a channel, to show the advantages.

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