

Singularities in PDE and the calculus of variations

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The nonlocal Burgers equation: existence of Shock waves in radiating gas

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Abstract

Models which admit discontinuous solutions are of fundamental importance for our understanding of condensed matter. A well known example is the classical periodic L^2 minimizer (laminate) with an arbitrary number of sharp interfaces of the nonlocal van der Waals double-well free energy functional (derived in 1893 with the assumption of pseudoassociation of complexes of molecules).

Here we focus on the Euler system of conservation of mass, momentum and energy for a radiating gas, with the constitutive first two laws of thermodynamics and in which the heat flux q is given by an integral equation. By perturbing the system about an equilibrium state and the speed of sound, we obtain the equation $u_t + uu_x + u - K \star u = 0$ as the first order approximation. We establish the existence of its shock waves by the elliptic method of sub/super-solutions.

This work is to appear in Applied Mathematics Letters. Recently, Xinfu Chen from University of Pittsburgh obtained a similar result with more general assumptions using the more complicated sliding method.