Linear growth rate for the quasi-isobaric ablation front model of Kull-Anisimov

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We propose to study a model, called the quasi-isobaric model [4] used for the study of the ablation front and of the related Rayleigh-Taylor instability. This model appears in the set up of the Inertial Confinement Fusion [2], [3], as a way of understanding the growth of a defect on the boundary of the capsule of deterium-tritium which is ignited. Under the hypothesis of low Mach number, which implies that the variations of the pressure are negectible with respect to the pressure itself, the equation for the enthalpy can be simplified into a non linear heat equation of the form

$$\mathrm{div}(\vec{u} + CT^{\nu}\nabla T) = 0, \rho T = C_0.$$

The steady-state solution of the Euler equation with an external gravity and a convection velocity with this simplified entalphy equation shall be described, and by using the normal modes theory we study the linear growth rate of the instability generated by this physical set-up. We obtain the necessary condition for the existence of a bounded solution for the perturbed system of equations, by means of its Evans function [1], and we identify the leading order term of the maximum growth rate with respect to physical parameters (length of the ablation region and Froude number). This calculation is a consequence of the identification of the solution of a linear system with variable coefficients. This identification is done in a non classical case for systems of ODEs, case where the coefficients converge slowly to their limit at infinity.

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