Combustion in a porous medium with two layers: The Cauchy problem.

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Abstract

We prove the local existence of the classical solution for the Cauchy problem of a system of nonlinear equations. The system is a model for flows with combustion in a porous medium with two parallel layers. It describes the combustion of oxygen and a solid fuel, such as coke. The model consists of two nonlinear parabolic equations coupled with two ode's based on Arrhenius's law. The former model the temperature, and the later, the fuel concentration, in each layer. Our main assumption is that the initial temperatures are lipschitzian continuous functions.

Our result is strongly based on a careful analysis of the construction of the fundamental solutions for parabolic equations. Since our argument depends on the existence a fixed point for the integral representation of the system of parabolic equations, which coefficient are functions of the fuel concentrations, we have to study how several estimates, regarding the fundamental solutions, behave in relation to the coefficients of the parabolic equations.

The model was studied in [1], where was proved the existence of travelling waves, and in [2], where was solved the Cauchy problem assuming known the fuel concentrations. The technique in [2] of super and subsolutions differs from ours, since the iterative monotone method of super and subsolutions do not apply for the full system, when the fuel concentration are also unknown. Our main references for the construction and analysis of fundamental solutions for parabolic equations are [3] and [4].

References

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