

Seventh Mississippi State - UAB Conference on Differential Equations Computational Simulations, November 1–3, 2007, Doubletree Hotel, Birmingham, AL, USA

WAVE FRONT SOLUTIONS IN THE THEORY OF BOILING LIQUIDS

RUEDIGER LANDES

In order to model the phase transition from nucleate to transient boiling Professor Marquardt from Aachen proposed to consider the the heat equation in the wall of the heater with a nonlinear Neumann boundary condition toward the boiling liquid due to the change of the heat conduction coefficient. The phase transition then will be modeled by a so-called wave front solution in the heating surface, which describes the sudden change of the temperature in the surface as a consequence of the transition.

For the one-dimensional heat equation with a nonlinear inhomogeneous term the existence of wavefront solutions is well known. Work of Aronson and Weinberger also dealt with the more-dimensional situation and showed that there are "sub-solutions" which behave like wavefronts. Hence the actual solutions also must have a sudden change of state. However this model with the nonlinearity in the equation rather than the boundary condition can be justified for (infinitely) thin surfaces only.

Here we present a similar theory for the nonlinear Neumann problem. We discuss an approach which provides a wavefront type sub-solution and hence establish a first mathematical confirmation of Marquardt's model. We also present some numerical solutions for the related elliptic problem.

UNIVERSITY OF OKLAHOMA
E-mail address: rlandes@ou.edu