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4th International Conference and Exhibition on
Materials Science & Engineering
September 14-16, 2015 Orlando, USA

Perturbation analysis of the solidification problem for a sphere in a porous media

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The moving boundary problem for solidification and melting is of interest to many fields. Carslaw and Jaeger claim only certain solutions known for certain geometries, and it is difficult to find exact solutions, in general, for the case. The moving heat source melting is treated with various transformations together with a decoupling for the heat and mass transfer terms. Some of the earlier works on the interface boundary are by Mullins Sekerka, and Pedroso Domoto. The classic work of Mullins Sekerka dealt with a perturbation analysis of the moving phase interface. Very little published work has appeared on the overall stability of the solid liquid interface in relation to the diffusive field with imposed convective boundary conditions. The classic problem known as the 'Stefan problem' was formulated over 100 years ago, yet the convective and radiative boundary condition case remains unsolved. In this paper, the coupled diffusive heat and mass transfer equations in porous media are solved for convective boundary condition, both by perturbation methods and exact methods. A stability criterion is derived for the moving interface in the convective case, with appropriate linearization.

Biography

Rahul Basu obtained his Engineering degrees from California Institute of Technology and UCLA, Los Angeles in Materials Science and Mechanical Engineering. As a Scientist at Gas Turbine Research Establishment he has obtained several patents on joining processes for superalloys, (the first in Gas Turbine Research Est, India) and has more than 40 refereed papers to his credit. He has also visited NCSU, RTP, NC USA on leave as a Teaching Fellow and took research courses in Heat transfer and cleared the PhD requirements. He was awarded a PhD by Eurotech on the basis of collected works before returning to India. After 30 years' service to GTRE, he joined VTU as a Professor. This work is an outcome of his current research on exact solutions to coupled diffusion equations.

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