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博　士　論　文　の　要　旨

専攻名　　システム創成科学専攻

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博士論文題名

（外国語の場合は，和訳を付記する。）

Numerical and Similarity Analysis on Heat and Mass Transfer of Liquid Film flowing along an Inclined Porous Wall

（傾斜した多孔質壁に沿って流下する液膜の熱及び物質移動に関する数値計算及び相似解）

要旨（２，０００字程度にまとめること。）

Interfacial wave behavior and flow characteristics of falling liquid films on an inclined porous wall have been studied by means of a numerical simulation. Basic equations are discretized on a staggered grid fixed on a physical space. Using the Navier-Stokes and Darcy-Brinkman equations in the film and porous layer, respectively, the problem is reduced to study of the evolution equation for the free surface of the liquid film derived through a long-wave approximation. Interfacial boundary conditions are treated with an originally proposed method and the wave behavior can be calculated accurately. Small artificial perturbations given at the inflow boundary grow rapidly and then the amplitude of the waves approaches to developed waves. Calculations have been performed in the wide range of physical parameters, in particular for inclined porous wall.

Heat and mass transfer for liquid evaporation along a vertical plate covered with a thin porous layer has been investigated. The continuity, momentum, energy and mass balance equations, which are coupled nonlinear partial differential equations are reduced to a set of two nonlinear ordinary differential equations and solved analytically and numerically by using shooting technique in MATLAB. The effect of various parameters like the Froude number, the porosity, the Darcy number, the Prandtl number, the Lewis number and the driving parameters on the flow, temperature and concentration profiles are presented and discussed. It is clearly viewed that the heat transfer performance is enhanced by the presence of a porous layer. The local Nusselt number and the local Sherwood

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numbers are computed and analyzed both numerically and graphically.

Similarity solution of heat and mass transfer for the falling film flow on a porous medium in presence of heat generation or absorption has been modeled by Darcy-Brinkman equations and solved by using similarity technique. Heat generation, thermal radiation and chemical reaction effects are considered. By using appropriate transformations, the governing nonlinear partial equations are transformed into coupled nonlinear ordinary differential equations. Graphs are decorated to explore the influence of physical parameters on the non-dimensional velocity, temperature and concentration distributions. The local Nusselt number and the local Sherwood number are computed and analyzed numerically.

Effect of thermal radiation and chemical reaction on heat and mass transfer flow over a moving porous sheet with suction and blowing has been investigated. Thermal radiation and chemical reaction effects are considered. By using appropriate transformations, the governing nonlinear partial equations are transformed into coupled nonlinear ordinary differential equations. Graphs are decorated to explore the influence of physical parameters on the non-dimensional velocity, temperature and concentration distributions. The skin friction, the local Nusselt number and the local Sherwood number are computed and analyzed numerically.