Notes on Numerical Fluid Mechanics
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Numerical Simulation of Oscillatory Convection in Low-Pr Fluids

Edited by Bernard Roux

Numerical Simulation Of Oscillatory Convection In Lowpr Fluids

Wa Kwok

Numerical Simulation Of Oscillatory Convection In Lowpr Fluids:

Numerical Simulation of Oscillatory Convection in Low-Pr Fluids Bernard Roux,2013-03-08 For the last ten years there has been an ever increasing awareness that fluid motion and transport processes influenced by buoyancy are of interest in many fields of science and technology In particular a lot of research has been devoted to the oscillatory behaviour of metallic melts low Pr fluids due to the very crucial impact of such flow oscillations on the quality of growing crystals semi conductors or metallic alloys for advanced technology applications Test cases on the 2D oscillatory convection in differentially heated cavities containing low Pr fluids have been defined by the organizing committee and proposed to the community in 1987 The GAMM Worshop was attended by 55 scientists from 12 countries in Oct 1988 in Marseille France Twenty eight groups contributed to the mandatory cases coming from France 12 other European countries 7 and other countries USA Japan and Australia 9 Several groups also presented solutions of various related problems such as accurate determination of the threshold for the onset of oscillations thermocapillary effect in open cavities and 3D simulations Period doubling quasi periodic behaviour reverse transition and hysteresis loops have been reported for high Grashof numbers in closed cavities The workshop was also open to complementary contributions 5 from experiments and theory stability and bifurcation analysis The book contains details about the various methods employed and the specific results obtained by each contributor **Numerical Simulation of Natural Convection in Porous Media** D. Brian Spalding,Imperial College of Science and Technology. Computational Fluid Dynamics Unit,1984 **Convection with Local Thermal Non-Equilibrium and Microfluidic Effects** Brian Straughan,2015-07-08 This book is one of the first devoted to an account of theories of thermal convection which involve local thermal non equilibrium effects including a concentration on microfluidic effects The text introduces convection with local thermal non equilibrium effects in extraordinary detail making it easy for readers newer to the subject area to understand This book is unique in the fact that it addresses a large number of convection theories and provides many new results which are not available elsewhere This book will be useful to researchers from engineering fluid mechanics and applied mathematics particularly those interested in microfluidics and porous media **Numerical Simulation of Forced Convection in a Two Fluid Layered System in a Floating Zone Configuration** N. Ramachandran,1989 **One Dimensional Numerical Simulation of Turbulent Oscillatory** Wa Kwok,1990

Convection in Fluids Radyadour Kh. Zeytounian,2009-07-21 This monograph entirely devoted to Convection in Fluids presents a unified rational approach of various convective phenomena in fluids mainly considered as a thermally perfect gas or an expansible liquid where the main driving mechanism is the buoyancy force Archimedean thrust or temperature dependent surface tension in homogeneities Marangoni effect Also the general mathematical formulation for instance in the B nard problem heated from below and the effect of free surface deformation are taken into account In the case of atmospheric thermal convection the Coriolis force and stratification effects are also considered This volume gives a rational and analytical analysis of the above mentioned physical effects on the basis of the full unsteady Navier Stokes and Fourier NS F equations for a Newtonian compressible viscous and heat conducting fluid coupled with the associated initials at initial time boundary lower at the solid plane and free surface upper in contact with ambiant air conditions This obviously is not an easy but a necessary task if we have in mind a rational modelling process and work within a numerically coherent simulation on a high speed computer *Numerical Simulation of Fluid Flow and Heat/mass Transfer Processes* N. C. Markatos,1986

Numerical Simulation of Time-dependent Thermocapillary Convection in Layered Fluid Systems Leonard Joel Peltier,1992 **Numerical Simulations of Thermal Convection in Rapidly Rotating Spherical Fluid Shells** Zi-Ping Sun,1992 Numerical Simulation of 2-Dlaminar Flow, Heat Generation and Forced Convection from Rectangular Blocks in a Narrow Channel İbrahim Özkol,1992 In this study a directional implicit Computational Fluid Dynamics CFD finite difference code is developed so as to simulate the direct and indirect heat removal through conduction and convection processes from the rectangular blocks attached to the lower surface of a narrow channel geometry Two dimensional unsteady incompressible laminar form of the Navier Stokes N S equations are considered L sing the stream function vorticity approach they are discretized via finite difference technique under the assumption of the Taylor series expansions The discretized equations than reduced to a three banded form of a matrix equality ready to be used conjugate solution formulation In the same manner two dimensional unsteady energy equation discretized with the source term included into three banded matrix form Tw o field equations are solved numerically for various channel rectangular block geometries so as to study the steady state heat transfer characteristics inside channel with possible heat generation inside the blocks It is shown that the numerical model is capable of simulating the main features of the flow field Detailed benchmarks of the present numerical model is attempted so as to validate the devoloped algorithm The streamvise extension of the recirculation zone behind the rectangular block which is a function of the Reynolds number is very well simulated Furthermore it was shown that the heat transfer characteritics of the zone agrees well with the experin ental and theoretical observations in the literature Prepared algorithm is a highly stable algorithm but show ing slow convergence to a steady state value Conjugate solution property of the present approach enables one to study complex thermal characteristics of fluid solid and solid solid interactions Beside the classical boundary conditions of the thermal field the problem domain is further complicated by the presence of discrete heat sources in the rectangular blocks in form of the infinite small heat generating sheet Heat generatedat various transfer positions are convected by the fluid downstream The near wall flow temperature and the Nusselt number distributions over the surface depict the most features of the complex fluid solid interaction The steady state temperature inside the blocks and in the substrate are found to be functions of the flow Reynolds number Prandtl number heat source position and substrate bottom surface temperature Due to the heat generation the flow is heated well above its inlet value This causes continous heat flow from fluid to the lower plate in the recirculating regions of the rectangular blocks and in the cavities where there are more than one obstacle The present model can simulate the chip cooling problems for integrated circuit components i e chips on a horizontal printed curcuit board which is containing heat generatin rectangular blocks attached to a single layer substrate Results consistency with other studies which are reported in literature is discussed **Convection in Fluids** Radyadour Kh. Zeytounian,2009-08-29 This monograph entirely devoted to Convection in Fluids presents a unified rational approach of various convective phenomena in fluids mainly considered as a thermally perfect gas or an expansible liquid where the main driving mechanism is the buoyancy force Archimedean thrust or temperature dependent surface tension in homogeneities Marangoni effect Also the general mathematical formulation for instance in the B nard problem heated from below and the effect of free surface deformation are taken into account In the case of atmospheric thermal convection the Coriolis force and stratification effects are also considered This volume gives a rational and analytical analysis of the above mentioned physical effects on the basis of the full unsteady Navier Stokes and Fourier NS F equations for a Newtonian compressible viscous and heat conducting fluid coupled with the associated initials at initial time boundary lower at the solid plane and free surface upper in contact with ambiant air conditions This obviously is not an easy but a necessary task if we have in mind a rational modelling process and work within a numerically coherent simulation on a high speed computer **Numerical Simulations of Fluid Flow and Convection Heat Transfer Through Fluid/porous Layers** Baili Zhang,1999 **Thermofluid Dynamics of Turbulent Flows** Michele Ciofalo,2021-08-16 The book provides the theoretical fundamentals on turbulence and a complete overview of turbulence models from the simplest to the most advanced ones including Direct and Large Eddy Simulation It mainly focuses on problems of modeling and computation and provides information regarding the theory of dynamical systems and their bifurcations It also examines turbulence aspects which are not treated in most existing books on this subject such as turbulence in free and mixed convection transient turbulence and transition to turbulence The book adopts the tensor notation which is the most appropriate to deal with intrinsically tensor quantities such as stresses and strain rates and for those who are not familiar with it an Appendix on tensor algebra and tensor notation are provided **Convection in Coupled Fluid-Porous Media Systems** Matthew Mccurdy,2020 We perform linear and nonlinear stability analyses for thermal convection in a fluid overlying a saturated porous medium in addition to conducting novel numerical simulations We use a coupled system with the Navier Stokes equations and Darcy s equation governing the free flow and the porous regions respectively Incorporating a dynamic pressure term in the Lions interface condition which specifies the normal force balance across the fluid medium interface permits an energy bound on the typically uncooperative nonlinear advection term enabling new nonlinear stability results Within certain regimes the nonlinear stability thresholds agree closely with the linear ones and we quantify the differences that exist We then compare stability thresholds produced by several common variants of the tangential interface conditions using both numerics and asymptotics in the small Darcy number limit Furthermore we investigate the transition between full convection and fluid dominated convection using both numerics and a heuristic theory This heuristic theory is based on comparing the ratio of the Rayleigh number in each domain to its corresponding critical value and it is shown to agree well with the numerics regarding how the transition depends on the depth ratio the Darcy number and the thermal diffusivity ratio Finally we detail the numerical methods used to simulate the coupled system Our analyses and the heuristic theory are then verified with our numerical results Numerical Simulation of Rotating Turbulent Thermal Convection S. Raasch,1991 *Convection and Chaos in Fluids* Jayanta K. Bhattacharjee,1987 The book describes the progress made in understanding the phenomena of various hydrodynamic instabilities over the last thirty years Exact results for the onset of Rayleigh Benard convection in different systems are presented and approximation techniques like amplitude equations and few mode truncations are treated at length Routes to chaos and the characteristics of the chaotic state are reviewed Certain features of the Taylor Couette flow and the effect of parametric modulation on hydrodynamic instabilities are discussed The theory is supplemented by experimental results *Oscillatory Convection in a Dilute 3e-superfluid 4He Solution* Yoshiteru Maeno,1984 Numerical Simulation and Control of Thermocapillary Convection in Cavities and Liquid Layers Changhai Chen,1994 Numerical Simulation of Two Phase Fluid Flow with Long Range Surface Forces Matthew James Buoni,2004

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