

Preface

This book is devoted to an account of theories of thermal convection which involve local thermal non-equilibrium (LTNE) effects, or are particularly important in a microfluidic situation. The term “local thermal non-equilibrium” refers to thermal convection in a fluid saturated porous material where the fluid temperature and the temperature of the solid skeleton may be different. Microfluidics refers to fluid dynamics on a small scale which may involve thermal convection in a clear fluid, or thermal convection in a fluid saturated porous medium. The areas of microfluidics and nanofluidics are very topical at present.

This is not an attempt to survey the area of convection with local thermal non-equilibrium effects, nor that of convection in a microfluidic scenario. Both topics are extremely popular research areas and such a survey would be a gargantuan task. For example, if one inserts “local thermal non-equilibrium” in the Springer query box, 12,197 entries are found, on 30th August, 2014. Likewise if one enters the same expression in the query box of Science Direct, 123,332 entries are found, on 30th August, 2014. This book is simply an account of what I believe is an appropriate collection of subjects in a very topical area.

Chapters 2–7 deal specifically with LTNE effects whereas chapter 8 contains work with LTNE effects and some microfluidic work employing a single temperature. Chapters 9–15 concentrate mostly on microfluidic situations where a single temperature field is employed although section 15.4 is concerned with LTNE. Sections 6.1, 6.2, 9.4, 12.3, 13.2, 13.3, 14.2, 14.3, 14.5, 15.3 and 15.4 contain new material and/or new numerical results which I believe are not available elsewhere.

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