# Preface

Over the past 50 years, the problem of supercritical or near-critical fluids has turned from a particular aspect of phase transitions described in books on thermodynamics to an active domain of research involving a variety of fundamental topics in statistical physics, fluid dynamics, chemistry, as well as many applications in different industrial processes. Supercritical fluids have provided a canonical example in the study of critical phenomena and anomalous exponents. They have displayed remarkable effects in out-of-equilibrium physics and hydrodynamics where they have made possible laboratory experiments in an extreme parameter range usually achieved only in geophysical or astrophysical flows. They also involve rapidly developing applications in engineering such as the ones taking benefit of the peculiar properties of chemical reactions in supercritical fluids.

Although there exist excellent books on each facet of the above subjects, a consistent account of the field is needed since it has become increasingly difficult to follow the literature on all these different topics. In addition, most books on supercritical fluids consider either the fundamental problems statistical of statistical physics or the aspects related to engineering processes in fluid dynamics or chemistry without making connection between these fields. This book will thus fill a gap in the existing literature. The authors have made a major effort to introduce the fundamental concepts, both in statistical physics and in hydrodynamics to readers who have no previous knowledge of these fields. They then present more specialized material on heat transfer, boiling, and hydrodynamic instabilities in supercritical fluids with emphasis on related microgravity experiments. The authors have been most actively engaged in various studies on supercritical fluids in a remarkable collaborative effort over the past 30 years. This book is a witness to this fruitful collaboration that provided many results. In particular, pioneering studies on the piston-effect that is a mechanism of heat transfer characteristic of near-critical fluids, fluids are widely described in the book.

I hope that this book will provide a profitable introductory text addressed to graduate students but will also be useful to researchers studying one of the many aspects of supercritical fluids.

Paris, February 2014 Stephan Fauve

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