Preface

Dimensional analysis is a clever strategy for extracting knowledge from a remarkably simple idea, nicely stated by Richardson

> ''… that phenomena go their way independently of the units whereby we measure them.''

Within its limits, it works excellently, and makes possible astonishing economies in effort. The limits are soon reached, and beyond them it cannot help. In that it is like a specialized tool in carpentry or cooking or agriculture, like the water-driven husking mill I saw in Viet Nam a few days before writing this preface, which husks rice elegantly and admirably but cannot do anything else.

Some of the motivation for writing this book came from lectures I gave to first-year students at Cambridge in 1996. I had used dimensional analysis many times before, but when I came to teach it I looked for a textbook. I was disappointed in the existing books, particularly in their treatment of fundamentals. Many of the better books were long out of print: Langhaar's *Dimensional analysis and theory of models*. (Chapman & Hall (1951)) is one of them. Birkhoff's *Hydrodynamics: a study in logic, fact and similitude* (Princeton University Press (1960)) is an inspiration, and everyone ought to read it at some time, but as an introduction for undergraduates it is inaccessible and overdemanding.

Students coming from school often undervalue dimensional analysis and are confused about what it can accomplish. They imagine that dimensional analysis can be used to confirm results that have been secured by some other route, but that it cannot be used to derive new results. Often the method has been linked to power-law relationships, and they

suppose that all relationships have that form, or that all relationships to which dimensional analysis applies are necessarily power laws, or that dimensional analysis is part of fluid mechanics and has no relevance anywhere else. Those notions are all completely false, and can be dangerously misleading.

I had in mind a slim volume that would put forward the basis ideas succinctly but accurately, and that would include many examples from engineering and physics, carefully chosen so that they are interesting and sometimes surprising. The starting point was a conversation with my friend and colleague Rex Britter. At first Rex was going to be a co-author, but in the event his many other commitments made that impracticable for him, something that I much regret. He showed me notes on dimensional analysis written for students by the late Harry Shercliff, who for a lamentably brief time was Head of the Department of Engineering at Cambridge, and before that a professor at Warwick: they influenced the approach to the underlying theory in Chapter 4. Herbert Huppert of the Department of Applied Mathematics and Theoretical Physics gave a lecture for schools, with the engaging subtitle 'something for (almost) nothing', and that was another inspiration.

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The mistakes are mine, and I would like to know about them.

Andrew Palmer
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