Preface

> 'Materials, of themselves, affect us little; it is the way we use them which influences our lives'. Epictetus, AD 50–100, *Discourses* Book 2, Chapter 5.

New materials advanced engineering design in Epictetus' time. Today, with more materials than ever before, the opportunities for innovation are immense. But advance is possible only if a procedure exists for making a rational choice. This book develops a systematic procedure for selecting materials and processes, leading to the subset which best matches the requirements of a design. It is unique in the way the information it contains has been structured; the structure gives rapid access to data and it gives the user great freedom in exploring the potential of choice. The method is available as software* which allows even greater flexibility.

The approach emphasizes design with materials rather than materials 'science', although the underlying science is used, whenever possible, to help with the structuring of criteria for selection. The first six chapters require little prior knowledge: a first-year engineering knowledge of materials and mechanics is enough. The chapters dealing with shape and multi-objective selection are a little more advanced but can be omitted on a first reading. As far as possible the book integrates materials selection with other aspects of design; the relationship with the stages of design and optimization, and with the mechanics of materials, are developed throughout. At the teaching level, the book is intended as the text for 3rd and 4th year engineering courses on Materials for Design: a 6 to 10 lecture unit can be based on Chapters 1 to 6; a full 20+ lecture course, with associated project work with the associated software, uses the entire book.

Beyond this, the book is intended as a reference text of lasting value. The method, the charts and tables of performance indices have application in real problems of materials and process selection; and the catalogue of 'useful solutions' is particularly helpful in modelling — an essential ingredient of optimal design. The reader can use the book at increasing levels of sophistication as his or her experience grows, starting with the material indices developed in the case studies of the text, and graduating to the modelling of new design problems, leading to new material indices and value functions, and new — and perhaps novel — choices of material. This continuing education aspect is helped by a list of further reading at the end of each chapter, and by a set of problems covering all aspects of the text. Useful reference material is assembled in Appendices at the end of the book.

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* The Cambridge Materials Selector (*CMS*), available from Granta Design, Trumpington Mews, 40B High Street, Trumpington, Cambridge CB2 2LS, UK.

of a selection exercise is, often, most easily done in the same way. Although the book itself is copyrighted, the reader is authorized to make copies of the charts, and to reproduce these, with proper reference to their source, as he or she wishes.

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