Form, Structure and Mechanism

FORM, STRUCTURE AND MECHANISM

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Introduction: the Use of this Book

The chief aim of this book is to help students of mechanical engineering to learn to design and to understand the deep and subtle relations between design and engineering science. It is also an original book, in which there are developed ideas which are not to be found in such a complete form elsewhere, and on that account it will be of interest both to experienced engineers and to those with other interests in design.

Experienced mechanical engineering designers build up characteristic ways of thinking and stocks of ideas, and this book aims to help the student to lay the foundations for such expertise early on and in a superior way. The scope is limited to form, structure and mechanism, because it is these areas which are crucial and in which design thinking is best seen. It is not intended to replace books on machine component design, such as those by Shigley and Juvinall, and it is expected that the reader has or will study such a book.

The student should simply read this book, checking the mathematics where appropriate and noting the engineering science given in condensed form where it is required. The reasoning should be followed with special care, because it embodies the *design thinking* that it is intended to teach.

Valuable ideas spring from insight and a firm grasp of the essence of the problem, so much of the book is concerned to show how to develop these prerequisites in key areas such as structures. This understanding is then applied, in the later chapters, to a number of products. The final chapter summarises and further illustrates the ideas which have been presented in the rest of the book.

It is desirable, but not essential, that the reader should understand simple statics (forces, moments and equilibrium), engineers' bending theory and instantaneous centres. Sixth form calculus is also necessary to

develop a few of the results. Some of the ideas depend on an ability to visualise relationships in three dimensions, and here a rough cardboard model may sometimes help.

Experienced and able designers will recognise many of the ideas in this book, and perhaps recall the time it took to acquire them. Such readers, I hope, will find here, together with things they already know, others which will be new and interesting, and sometimes of direct applicability in their work.

I have chosen examples which are typical of a wide range of problems, which are simple, and where the background is not too complicated to explain in a few paragraphs. I have probably overlooked some excellent examples which might have been used, and I should always be grateful to any reader who reminded me of one, or, even better, introduced me to one that I had never met. A beautiful concept in design is like a brilliant development in a string quartet, a source of delight which never fails.

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