

THE
ELEMENTS
OF
Mechanical Design

BY
JAMES G. SKAKOON

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PREFACE

This book contains principles and practices for mechanical designers. They come from the experience, know-how, and intuition of expert designers, but they represent engineering fundamentals in a practical way.

Consider two examples. Even children quickly learn that carrying two pails of water, one on each side, is easier than carrying a single pail on the right or left. This is not an isolated observation, but a useful principle of design described in this book (self-help). Or haven't we all spilled a drinking glass on a table that teeters side-to-side on two legs, resting now on the third, now on the fourth? Four-legged tables are fundamentally flawed and represent another design principle described in this book (over-constraint). Agreed, these cases are obvious enough. But in this book they become principles and guidelines, explicitly stated, to be applied to other design problems—where they may be rather less obvious.

This book is not about engineering science. Established books exist for machine design, structural analysis, and kinematics. Neither is it about design for manufacturability nor about the design process; excellent books have been written, especially in recent years, for these subjects as well. Nonetheless, despite an increased emphasis on design and manufacturing in both university curricula and practical literature, existing books have little about mechanical design as practiced by experienced designers.

Good designers often understand and use the ideas in this book whether or not they recognize them as distinct principles. Many designers, myself included, learned them either by trial and error or by exploiting colleagues' experience. Perhaps everything here would be part of all designers' practice were they to design long enough. But all too often designers are unaware of or do not fully grasp ideas that experts use to great advantage.

Therefore, in this book I explicitly state design principles and practices: 1) so beginning designers do not have to discover them on their own as I had to, and 2) so all designers can apply them as fundamental concepts throughout their designs.

Although nothing in this book is new, its narrow focus on basic, detail-level mechanical design is unique. Use it as a primer, and a refresher, on good mechanical design.

James G. Skakoon

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I interviewed designers to confirm and add to the book's content. Comments repeated themselves with remarkable consistency, but many were unique. You can read some of the good ones in Appendix D.

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