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Book Reviews

Cam Design Handbook by Harold A. Rothbart, McGraw Hill Professional, October 2003

REVIEWED BY DENNIS L. KLIPP[1]

This handbook offers a collection of both practical and theoretical topics on the subject of cam design and manufacture. Portions of the book are based on the editor's previous book, *Cams-Design, Dynamics and Accuracy* (John Wiley & Sons, Inc., 1956) with the addition of updated design techniques and manufacturing processes. The emphasis is toward cams for industrial automation but material for automotive engines cams is also included. Ten of the sixteen chapters are written by the author/editor with the balance of the chapters written by nine contributors from both academia and industry. Six appendices and a twenty page index complete the book.

The first five chapters cover cam terminology, a general process for approaching the cam design task, and the kinematic characteristics and equations for a plethora of cam motions. The motions presented include constant velocity, geometrically defined profiles, trigonometric curves, the modified or composite curves, polynomials and splines. Qualitative remarks regarding the appropriateness of the motions are interspersed in the individual descriptions but no comprehensive summary is made. An experienced designer would find value in the motion presentation as a reference but the novice desiring a guide for proper motion selection could find it confusing. Polynomials are presented as discrete curves rather than a powerful technique for the creation of motions with customized kinematic characteristics.

Chapter 5 on splines deserves special comment. Written by Huey and Tsay, it deftly presents the theory of splines and their application to more demanding cam motion situations.

The next five chapters cover cam geometry and profile characteristics, cam loading, materials and lubrication, and cam manufacturing. Chapter 7 presents a detailed study of planar cam profiles that would be of interest to the more advanced reader.

Dynamic modeling of cam systems for flexible follower systems is presented in the Chapters 11, 12 and 13. Chapter 11 nicely introduces the principles of modeling in general. The next two chapters go through the analytical aspects of cam system modeling in a thorough fashion.

A number of special cam mechanisms are described in Chapter 14. Many of the devices that are explained have historical value only. Cam indexing is briefly introduced.

Chapter 15 is a paper on Microelectromechanical Systems. While very fascinating, this topic is quite futuristic with little practical application at present.

The final chapter is a short introduction to automotive camshaft design and includes a list a software packages that address this specialized area.

In conclusion, Rothbart's ''Cam Design Handbook'' contains a comprehensive and complete range of information on the subject. In this reviewer's opinion, it is appropriate as a reference book for more experienced engineers. The lack of a summary regarding a proper cam motion selection criterion is a shortcoming. One appendix lists a number of computer programs and applications that can assist in cam design but it is left to the reader to evaluate the appropriateness of the programs. With the exception of programs for automotive valve cams, this reviewer is concerned about the ease of implementation of programs that date to the 1970's and 1980's.

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Cam Design and Manufacturing Handbook by Robert L. Norton, Industrial Press, Inc., November 2001

Comprised of 18 chapters, 4 appendices, a bibliography, glossary of terms and a 9 page index, this book is really a combination of a reference handbook and a textbook covering all aspects of cam design and manufacture for both industrial and automotive valve cams. The multi-colored graphs and illustrations are concisely executed. Also included is a CD containing demonstration programs for Dynacam, FourBar, SixBar and Slider, computer applications written by the author. Dynacam is used throughout the book to compute the numerous motion examples and its operation is introduced in Appendix A.

After an introduction in Chapter 1, the next five chapters are devoted to the definition and development of motions. Chapter 2 is titled ''Unacceptable Cam Curves'' and examines some of the traditional curves that have been used for cams. The ''Fundamental Law of Cam Design'' is introduced and all motions in this and the following chapters are qualified against it. The author takes the reader through example situations of motion design to clearly develop a thorough understanding of the design process for dynamically acceptable motions. In addition to the traditional and modified curves that have been applied to cams, the use of polynomials and b-splines are examined in detail. It should be noted that the motion design process is applicable to motions for servo driven mechanisms as well.

Cam size and profile determination, material selection, lubrication, failure and manufacturing considerations are deftly presented. Dynamic modeling for cam systems is explained in detail beginning with modeling fundamentals and progressing through actual examples of both industrial and automotive valve applications. Chapter 11 is devoted to residual vibrations in cam systems.

Chapter 16 introduces the reader to the instrumentation methods available for the measurement of cam system performance. Chapter 17 contains to case studies; an automotive valve application and an industrial automation case that demonstrate the application of the methods of design and instrumentation that have been introduced throughout the book.

Chapter 18 is a summation of design considerations for cam systems and includes 20 design guidelines for cam systems. These guidelines are useful to both novice and experienced engineers. This decision process is applicable to common cam design problems as well as the most complex cam system situations.

In this reviewer's opinion, Norton's *Cam Design and Manufac-*

turing Handbook is an essential and valuable tool for any engineer who is engaged in the design of cam systems or motion development for servo devices. The material is presented so that the reader can develop a real understanding of cam and motion technology. The availability of the ''Dynacam Professional'' computer application permits those engineers engaged in cam and motion design easy access to the implementation of the handbook's methods. The book would also be useful as a supplemental text for advanced undergraduate and graduate courses in cam mechanism design.