

Preface

Biomedical engineers often have difficulty understanding visual systems concepts, whereas non-engineers are often overwhelmed by the apparent complexity of biomedical applications of control theory. There is, moreover, lack of a book or reference source with a balanced treatment of these two needs. It is with this in mind that I have put together a coherent and relatively comprehensive monograph on oculomotor control, based primarily on my research work over the past 20 years. This monograph has two main objectives. First, it aims to provide the biomedical engineer with a thorough understanding of how various engineering control principles are applied to oculomotor systems. Second, it aims to provide the non-engineer with the fundamentals of control theory, and then leads them to understand how various physiological and clinical concepts can be represented quantitatively and efficiently by control systems models.

Oculomotor research involves a wide variety of disciplines. For example, it includes biomedical engineering, and the related fields of biophysics and mathematics. Non-engineering disciplines include neurology, ophthalmology, optometry and psychology. It is because of this breadth of disciplines that a unified and systematic approach is needed for a clearer understanding of oculomotor control. I believe this has been accomplished in the monograph. First, a glossary and introductory chapters on anatomy and physiology of eye movements and basic control systems concepts provide the necessary background. Then, the monograph applies these concepts to static linear and nonlinear analysis of various oculomotor systems. In addition, it presents advanced topics on the application of dynamic linear and nonlinear modeling techniques to the oculomotor system, with a particular emphasis on myopia development, which is an important international health concern.

This monograph has been enriched by the clinical and logical insights brought forth by Dr. Kenneth J. Ciuffreda, who has collaborated on a number of articles cited in the monograph. In addition, Dr. Bai-Chuan Jiang has

contributed substantially to the discussions on interactive accommodation and vergence system. It is hoped that the monograph will become a valuable reference for both bioengineers and vision scientists, and serve as the foundation for continued research in the fascinating and complex field of oculomotor control.

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