
REVIEWED BY BJORN D. TYRÉUS

This monograph is a collection of theoretical developments and practical applications of Rosenbrock's inverse Nyquist array approach to the design of control systems, single input single output as well as multivariable. Much of the material has been published earlier in separate articles but this book is nevertheless a valuable contribution to the art of automatic control particularly in the field of multivariable theory in the frequency domain.

Rosenbrock has not explicitly stated for whom the book is intended but it seems clear to me that this is not a course book in the traditional sense but a book intended for practicing engineers who are frequently confronted with multivariable control problems or who want to expand their knowledge in multivariable control theory. Unfortunately the book has a drawback in that there is no easy way into the material and onto the interesting results. The reason for this problem is a first chapter called "Introduction and Mathematical Background" where a series of definitions and theorems are stated. In this chapter the reader is not given a clear motivation for reading and understanding the somewhat abstract material. Not until after Chapter 3 can the theorems be fully appreciated. Rosenbrock apparently anticipating this problem suggests that one should skip the first chapter initially and go directly into Chapters 2 and 3. Although in my mind not an entirely satisfactory solution this is probably the best way to approach the book.

Altogether the book contains four chapters. The first chapter was mentioned above. The second chapter deals with control system design of single input single output plants. Rosenbrock shows how interactive computing can be used to effectively design a control system with given specifications. The use of the inverse Nyquist plot is emphasized even if other methods such as the direct Nyquist plot and root loci methods are also presented in fair detail. Chapter 2 contains a couple of interesting sections labeled "Sensitivity," "Irrational Transfer Functions," and "Non-minimum Phase Response" worth detailed study. Even though the book stresses computer calculations and interactive design there are no computer programs or examples of computer conversations included in the text. Instead references to places where such material can be found are given.

The heart of the book lies in Chapter 3 which deals with control systems for multivariable plants. The concept of diagonal dominance is introduced and based on this requirement it is shown how a control system can be designed such that it is stable and meets specifications set up by the designer. This chapter is clearly written and it is easy to follow the developments which are illustrated through examples and figures. Chapter 4 finally contains a series of applications of the theory presented in Chapter 3. Control systems for a pressurized flow box, a boiler furnace, a compressor, and an unstable batch process are designed in complete detail.

After reading Chapter 4 the reader should feel confident that he understands the inverse Nyquist array method and he is probably tempted to try this method provided that he can find the proper computer installation and the right programme package.

The book contains many solved examples and after each chapter a series of problems without answers are given. These are illustrative and help the reader understand the theory better. In summary, the book is somewhat difficult to get into but the reader who takes his time to go through the 230 pages will find this most rewarding and feel that he has gained increased knowledge and considerable insight.


REVIEWED BY ALAN N. WILLSON, JR.

During the past decade a large number of research papers have been published concerning the functional-analytic approach to the stability theory of feedback systems. In this book the important elements of that theory have been collected and carefully organized into a quite comprehensive treatment of the subject. The authors state in the Preface that "Our audience consists of mathematically inclined engineers interested in feedback systems." Indeed, the reader will have to be relatively mature mathematically in order to follow the details of the text and to work the exercises. In particular, in addition to the usual mathematics that one would encounter in a good undergraduate engineering curriculum, the reader should have also mastered the material contained in a course on mathematical analysis, including at least a minimal exposure to the Lebesgue theory. With this background, one will then be able to assimilate the material contained in the book's five appendices which includes, for example, necessary facts concerning Banach algebras, and some standard results of functional analysis and Fourier analysis. At this point the reader will then be properly prepared to begin reading the main body of the text, which consists of six chapters.

Chapter I is quite short. It presents the necessary material concerning nonlinear mappings that satisfy so-called sector conditions, and it provides an exposure to the concepts and manipulations that are useful for dealing with feedback loops containing such nonlinearities.

Chapter II provides a review of certain prerequisite mathematical tools and then, in Chapter III, the general framework for the problems which occupy the remainder of the book is laid down. The main results presented here are the small-gain theorem and the loop transformation theorem.