Diagnosis and Fault-Tolerant Control, by Mogens BLANKE, Michael KINNAERT, Jan LUNZE, and Marcel STAROSWIECKI, New York: Springer, 2006, ISBN 3-540-35652-5, 672 pp., $129.00.

This book raises two pertinent questions: Why should anyone reading *Technometrics* be interested in such a seemingly obscure and esoteric topic, and if one is so interested, is the current text an appropriate introductory vehicle? To answer the frst question, one need only note the large readership with educational backgrounds in engineering and, more specificall, engineering control. Furthermore, those readers are specificall focused on internal (or endogenous) and external (or exogenous) system changes. Faults are such internal or external system change agents. Fault-tolerant control is a scheme consisting of proactive measures taken so that the system will function effcaciously after the introduction of a fault.

Faults typically involve actuators, sensors, or other system components. The authors are careful to distinguish between faults and disturbances (and model uncertainties). The latter are already accounted for in traditional controller design (e.g., using fltering or robust design); the former require additional measures. The authors also briefl discuss robust and adaptive control. The reader may note the plethora of adaptive control methodology in the recent quality literature.

Given the nature of process monitoring in an engineering control environment, the appeal of such a topic should be obvious. But a caveat must be added. The alleged appeal lies in the nontechnical realization that a system that is tolerant to the effects of faults seems preferable to one that is not. However, the background required to delve into the details is another story.

The authors state that the book is designed for graduate engineering study. The requisite background is correspondingly obvious. Specificall, the reader needs a working knowledge of engineering control, (regular and stochastic) differential equations, matrix algebra, probability theory, and graph theory. These are not simply preferred. Short of Ramanujan, it is highly improbable that a reader would fnd the book overly useful (or enjoyable) otherwise.

The organization is strong, commencing with an introduction and basic examples. The authors then proceed through dynamical systems models, analysis based on components and architecture, and structural architecture. Fault diagnosis, control, and reconfiguratio dominate the four main chapters. The book concludes with a fnal chapter on applications, followed by references and appendixes. Overall, the coverage is fairly comprehensive.

The pivotal Chapter 7 introduces the main corpus of fault-tolerant control (FTC), covering topics such as passive and active FTC, available knowledge, supervision, architecture, and admissibility. Again, the authors motivate with examples before immersing the reader in the theorems, lemmas, and defini tions. The section culminates with a discussion of an iterative scheme (using Newton–Raphson iteration) to solve the algebraic Riccati equation. The reader is referred to the appendix for further instruction here.

Chapter 10 is the book's major strength, offering examples on a three-tank system, a chemical process, a ship propulsion system, supervision of a steam generator, and electrical steering of warehouse trucks. In contrast to examples in many analogous texts, these are well-constructed real-world cases. In each case, the authors present the normal case and the fault(s), sequenced similarly with the book itself. My personal favorite is the chemical process, having worked with polymers in the past. In this example, valve, heating element, and cooler faults are considered in an experimental study.

Each chapter contains many graphs and schematic diagrams that are often illuminating. Such use of visuals is not unexpected in an engineering text, because they link the mathematics with the system under study. A couple of strong examples are the simulation of a two-tank system to help illustrate controllability and the Kalman filte approach for a linear discrete-time model.

The three technical appendixes vary with respect to utility. The firs two, covering matrices and probability, are not introductory in nature. Such matrix concepts as homogeneous systems, vector spaces, and Jacobians are included. Similarly, the probability coverage begins with Gaussian and chi-squared variables, basic (and brief!) hypothesis testing, and stochastic processes. However basic these sections may or may not appear, the third appendix, on $H2$and$H\infty$ controller designs, is very unlikely to offer much for the reader lacking previous knowledge of the topic.

The fnal three appendixes on nomenclature, terminology, and a dictionary (in English, German, French, and Danish), vary in usefulness. (They do somewhat elucidate the nuances in differences between the three.) The terminology section is more of a dictionary, offering definition of terms. The dictionary functions as a translator across languages. If you happen to be in Copenhagen and experience a disturbance, be advised it is a forstyrrelse; but a signal is a signal is a signal is a signal! One other note: the book uses British spellings. Please avoid if you suffer from parameterisationaphobia.

A background in quality is not needed. However, the interested reader will run into a few familiar techniques, such as CUSUMs, FMEAs, and perhaps residual analysis. The book does not link quality methodology with engineering control (e.g., algorithmic process control) and does not purport to do so. Such a study would constitute a contribution to both felds.

The book offers no solved exercises, so the accuracy of such is a nonissue. The book is largely devoid of typos and syntax errors. This is laudable, even for a second edition; kudos to the Springer editorial staff.

The question of whether or not this book is appropriate must be answered by the prospective reader. In doing so, he or she must ask three questions: Do I need to learn about FTC?; how badly do I need to learn about FTC?; and is my engineering control (and math) background strong? If your answers are yes, badly, and yes, then this is the book for you. Any other set of answers, and the advice here is that there are many other quite admirable endeavors in life.

This book is as advertised. If you have a strong background in control theory and are interested in fault-tolerant control, this offers a comprehensive package. If you already have studied fault-tolerant control and need a reference work, this is a good one. However, if you fin the topic of interest and have no background in engineering control, then you have some catch-up work to do before to tackling this text. Good luck.

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