

# ETHICS IN ENGINEERING

Second Edition



Martin  
Schinzinger



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## ETHICS IN ENGINEERING

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Dr. Martin received a Matchette Foundation Award for teaching (as a graduate student) and an Arnold L. and Lois S. Graves Award for Teachers in the Humanities (1983). He has held two fellowships from the National Endowment for the Humanities and two grants from the Association of American Colleges. His articles on business and professional ethics, social philosophy, aesthetics, and literary criticism have appeared in many books and journals. He is editor of *Self-Deception and Self-Understanding* (1985) and author of *Self-Deception and Morality* (1986) and *Everyday Morality* (1989).

Roland Schinzinger was born and raised in Japan where his parents were teachers of German. He came to the United States in 1949 at the age of twenty-two and attended the University of California at Berkeley, where he received his B.S. (1953, Tau Beta Pi, Eta Kappa Nu), M.S. (1954), and Ph.D. (1966, National Science Fellow). He worked for the Westinghouse Electric Corpora-

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*For Shannon, for Ruth L. Martin,  
and in memory of Theodore R. Martin,  
Mike W. Martin*

*For Jane, for Robert Schinzinger,  
and in memory of Annelise Schinzinger.  
Roland Schinzinger*

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# PREFACE

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Technology has a pervasive and profound effect on the contemporary world, and engineering plays a central role in all aspects of the development of technology. Because of this it is vital that there be an understanding of the ethical implications of engineers' work. Engineers must be aware of their social responsibilities and equip themselves to reflect critically on the moral dilemmas they will confront. Managers must be responsive to the rights of engineers to exercise their consciences responsibly. The public must acquire an understanding of the extent and limits of the responsibilities of engineers; it must be prepared to shoulder its own responsibilities where those of the engineers end.

This book is written for students preparing to function within the engineering profession and for their colleagues in philosophy and the humanities who seek to apply ethical theory to the pressing problems of everyday life in a technological society. Its intended audience is also practicing engineers, social scientists, philosophers, and all those engaged in the enterprise of technology, including the general public.

## Purpose

*Ethics in Engineering* provides an introduction to the basic issues in engineering ethics, with emphasis given to the moral problems engineers face in the corporate setting. It places those issues within a wider philosophical framework than has been customary in the past, and it seeks to exhibit both their social importance and their intellectually challenging nature. The primary goal is to stimulate critical reflection on the moral issues surrounding engineering practice and to provide the conceptual tools necessary for pursuing those issues. The book is intended to be a teaching instrument while also serving to advance the field of engineering ethics.

In large measure we proceed by clarifying key concepts, sketching alternative views, and providing relevant case study material. Yet in places we argue for particular positions which in a subject like ethics can only be controversial. We do so because it better serves our goal of encouraging critical judgment than would a mere digest of others' views. Accordingly, our aim is not to force conviction, but to provoke either reasoned acceptance or reasoned rejection of what we say. We are confident that such reasoning is possible in ethics, and that, through lively and tolerant dialogue, progress can be made in dealing with what at first might seem irresolvable difficulties.

### Courses

Sufficient material is provided for full courses devoted to the topic. The book can also be used for a several-week module on engineering ethics within a variety of other courses in engineering, philosophy, business, and the social sciences—courses which typically include such topics as general professional ethics, business ethics, applied philosophical ethics, engineering law, business management, values and technology, engineering design, technology assessment, and safety. Despite the intensity of the engineering curriculum, engineering ethics should enter in several contexts to ensure that students perceive it as a genuine concern of the faculty.

### Outline

*Ethics in Engineering* is divided into four main parts, which emphasize, respectively, applied ethical theory, safety and risk, the corporate setting, and global awareness and career choice.

Part I provides an introduction to basic concepts and theories of ethics. Chapter 1 introduces and defines the field of engineering ethics as it relates to applied philosophical ethics. The roles of describing, evaluating, and clarifying in ethics are explained. The goal of fostering moral autonomy in studying ethics is emphasized in discussing the psychology of moral development. Chapter 2 introduces further key concepts: moral dilemmas, responsibility, and relativism. Three fundamental types of theories about right action—emphasizing duties, rights, and good consequences—are introduced. There is also a discussion of character, or virtue, ethics: the ethics of good and bad traits of character.

Part II deals with the moral issues surrounding safety assessments within the inherently risky activity of engineering. Chapter 3 develops a perspective on engineering as an experiment on a societal scale involving human subjects. This model provides a framework for discussing various aspects of responsible engineering practice: imaginative foreseeing of possible side effects, careful monitoring of projects, and respecting the rights of clients and the public to make informed decisions about the products which affect them. The model

also provides a context for discussing the importance and limitations of laws and codes of ethics in engineering. Chapter 4 explores some of the moral complexities of safety and risk decisions.

Part III examines some of the special moral issues arising for the nearly 90 percent of engineers who are employed by corporations. Chapter 5 approaches those issues by clarifying the ideas of professionalism, loyalty to employers, and employer authority. It also contains discussions of employee obligations to employers related to conflicts of interest, confidentiality, unionism, and white-collar crime. Chapter 6 focuses on the various rights of engineers: professional, employee, and human rights. Special topics include whistle-blowing, freedom of conscience, due process from employers, and discrimination or preferential treatment.

Part IV sketches further issues relating to global awareness and career choice. Chapter 7 explores connections between engineering ethics and international corporations, environmental ethics, computer ethics, and nuclear deterrence and weapons development. Chapter 8 examines the role of morality in making career choices in engineering. It also outlines a few additional issues concerning the responsibilities of the engineering profession.

The Appendix contains sample codes of ethics of several major engineering professional societies. Study questions are provided at the end of major sections of each chapter.

### Second Edition

Many recent case studies have been added for this edition. They include the space shuttle *Challenger*, Chernobyl, the Bhopal chemical disaster, acid rain, and industrial espionage. Several topics are new or given expanded treatment, such as white-collar crime, technology transfer, environmental ethics, character (or virtue) ethics, and the psychology of moral development. Many sections have been reorganized and rewritten to improve teachability and more effectively integrate theory and practical applications. This is especially true of Parts I and IV.

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This book was written after but inspired by our participation as a philosopher-engineer team in The National Project on Philosophy and Engineering Ethics from 1978 to 1980. We gratefully acknowledge the sponsor of that project, the National Endowment for the Humanities, and the project director, Robert J. Baum.

Mike Martin's work on the book was largely made possible by a fellowship from the National Endowment for the Humanities from 1981 to 1982. He is indebted to Nelson Pike and the Department of Philosophy at the University of California, Irvine, for granting him the status of Visiting Scholar during that time. In working on the second edition, he also was helped by a reduced teaching load from Chapman College.

We greatly benefited from the criticism and suggestions of participants in the classes we have taught together during the past several years. The formal course work ranged from segments of design courses given at the U.C.I. School of Engineering to full courses on engineering ethics taught in the U.C.I. Department of Philosophy and for the Masters Degree in Engineering Program of California State Polytechnic University, Pomona, taught at Fluor Corporation. An additional seminar brought together practicing engineers under the auspices of the Institute of Electrical and Electronics Engineers, Orange County Section. We have also been helped by the comments of audience members at lectures we gave at meetings of the American Philosophical Association, the Institute of Management Science, the American Society of Engineering Education and several other engineering societies at the Second and Third National Conferences on Engineering Ethics, and at the School of Engineering at the University of California, Santa Barbara.

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*Mike W. Martin*

*Roland Schinzinger*

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