

# **Engineering Ethics: Peace, Justice, and the Earth**

**Second Edition**

# Synthesis Lectures on Engineering, Technology and Society

Editor

**Caroline Baillie**, *University of Western Australia*

The mission of this lecture series is to foster an understanding for engineers and scientists on the inclusive nature of their profession. The creation and proliferation of technologies needs to be inclusive as it has effects on all of humankind, regardless of national boundaries, socio-economic status, gender, race and ethnicity, or creed. The lectures will combine expertise in sociology, political economics, philosophy of science, history, engineering, engineering education, participatory research, development studies, sustainability, psychotherapy, policy studies, and epistemology. The lectures will be relevant to all engineers practicing in all parts of the world. Although written for practicing engineers and human resource trainers, it is expected that engineering, science and social science faculty in universities will find these publications an invaluable resource for students in the classroom and for further research. The goal of the series is to provide a platform for the publication of important and sometimes controversial lectures which will encourage discussion, reflection and further understanding.

The series editor will invite authors and encourage experts to recommend authors to write on a wide array of topics, focusing on the cause and effect relationships between engineers and technology, technologies and society and of society on technology and engineers. Topics will include, but are not limited to the following general areas; History of Engineering, Politics and the Engineer, Economics, Social Issues and Ethics, Women in Engineering, Creativity and Innovation, Knowledge Networks, Styles of Organization, Environmental Issues, Appropriate Technology

Engineering Ethics: Peace, Justice, and the Earth, Second Edition

George D. Catalano

2014

Mining and Communities: Understanding the Context of Engineering Practice

Rita Armstrong, Caroline Baillie, and Wendy Cumming-Potvin

2014

Engineering and War: Militarism, Ethics, Institutions, Alternatives

Ethan Blue, Michael Levine, and Dean Nieusma

2013

Engineers Engaging Community: Water and Energy

Carolyn Oldham, Gregory Crebbin, Stephen Dobbs, and Andrea Gaynor  
2013

The Garbage Crisis: A Global Challenge for Engineers

Randika Jayasinghe, Usman Mushtaq, Toni Alyce Smythe, and Caroline Baillie  
2013

Engineers, Society, and Sustainability

Sarah Bell  
2011

A Hybrid Imagination: Science and Technology in Cultural Perspective

Andrew Jamison, Steen Hyldgaard Christensen, and Lars Botin  
2011

A Philosophy of Technology: From Technical Artefacts to Sociotechnical Systems

Pieter Vermaas, Peter Kroes, Ibo van de Poel, Maarten Franssen, and Wybo Houkes  
2011

Tragedy in the Gulf: A Call for a New Engineering Ethic

George D. Catalano  
2010

Humanitarian Engineering

Carl Mitcham and David Munoz  
2010

Engineering and Sustainable Community Development

Juan Lucena, Jen Schneider, and Jon A. Leydens  
2010

Needs and Feasibility: A Guide for Engineers in Community Projects — The Case of Waste for Life

Caroline Baillie, Eric Feinblatt, Timothy Thamae, and Emily Berrington  
2010

Engineering and Society: Working Towards Social Justice, Part I: Engineering and Society

Caroline Baillie and George Catalano  
2009

Engineering and Society: Working Towards Social Justice, Part II: Decisions in the 21st Century

George Catalano and Caroline Baillie  
2009

Engineering and Society: Working Towards Social Justice, Part III: Windows on Society  
Caroline Baillie and George Catalano  
2009

Engineering: Women and Leadership  
Corri Zoli, Shobha Bhatia, Valerie Davidson, and Kelly Rusch  
2008

Bridging the Gap Between Engineering and the Global World: A Case Study of the  
Coconut (Cair) Fiber Industry in Kerala, India  
Shobha K. Bhatia and Jennifer L. Smith  
2008

Engineering and Social Justice  
Donna Riley  
2008

Engineering, Poverty, and the Earth  
George D. Catalano  
2007

Engineers within a Local and Global Society  
Caroline Baillie  
2006

Globalization, Engineering, and Creativity  
John Reader  
2006

Engineering Ethics: Peace, Justice, and the Earth  
George D. Catalano  
2006

© Springer Nature Switzerland AG 2022

Reprint of original edition © Morgan & Claypool 2014

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means—electronic, mechanical, photocopy, recording, or any other except for brief quotations in printed reviews, without the prior permission of the publisher.

Engineering Ethics: Peace, Justice, and the Earth, Second Edition

George D. Catalano

ISBN: 978-3-031-00987-7      paperback

ISBN: 978-3-031-02115-2      ebook

DOI 10.1007/978-3-031-02115-2

A Publication in the Springer series

*SYNTHESIS LECTURES ON ENGINEERING, TECHNOLOGY AND SOCIETY*

Lecture #22

Series Editor: Caroline Baillie, *University of Western Australia*

Series ISSN

Print 1933-3633    Electronic 1933-3641

# Engineering Ethics: Peace, Justice, and the Earth

**Second Edition**

George D. Catalano  
State University of New York at Binghamton



*SYNTHESIS LECTURES ON ENGINEERING, TECHNOLOGY AND  
SOCIETY #22*

## **ABSTRACT**

A response of the engineering profession to the challenges of security, poverty and underdevelopment, environmental sustainability, and native cultures is described. Ethical codes, which govern the behavior of engineers, are examined from a historical perspective linking the prevailing codes to models of the natural world. A new ethical code based on a recently introduced model of Nature as an integral community is provided and discussed. Applications of the new code are described using a case study approach. With the ethical code based on an integral community in place, new design algorithms are developed and also explored using case studies. Implications of the proposed changes in ethics and design on engineering education are considered.

## **KEYWORDS**

engineering ethics, models of the natural world, engineering design, engineering education

*With gratitude and appreciation for my family and all my two- and four-legged friends and spiritual directors.*



# Contents

<b>Preface</b> .....	<b>xiii</b>
<b>Acknowledgments</b> .....	<b>xv</b>
<b>1 Introduction</b> .....	<b>1</b>
1.1 The Challenge of Security .....	1
1.2 The Challenge of Poverty and Underdevelopment .....	3
1.3 The Challenge of Environmental Sustainability .....	7
1.4 The Challenge of Native Cultures .....	9
1.5 Other Challenges .....	11
1.6 Concluding Remarks .....	11
<b>2 Engineering Ethics</b> .....	<b>13</b>
2.1 Historical Overview .....	13
2.2 Reviewing Today's Codes of Ethics .....	17
2.3 Concluding Remarks .....	18
<b>3 Models of the Earth</b> .....	<b>21</b>
3.1 Earth as Great Chain of Being .....	21
3.2 Earth as Mechanical Clock .....	21
3.3 Earth as Living System .....	24
3.4 Earth as Self-Organizing System .....	25
3.5 Concluding Remarks .....	27
<b>4 Engineering in a Morally Deep World</b> .....	<b>29</b>
4.1 Borrowing from Environmental Ethics .....	29
4.2 Case Study 1: Wolves in the Southwestern U.S. ....	30
4.3 A New Engineering Ethic .....	31
4.4 Case Study 2: A Plow for Mexican Peasant Farmers .....	32
4.5 Case Study 3: A Ticket-Tearing Device for a Disabled Person .....	33
4.6 Concluding Remarks .....	34

<b>5</b>	<b>Engineering Design in a Morally Deep World</b>	<b>37</b>
5.1	Overview of Traditional Engineering Design	37
5.2	Eco-Effective Design	38
5.3	A Design Algorithm for a Morally Deep World	40
5.4	An Enriched Morally Deep World Design Algorithm	41
5.5	Case Study 1: Grape Workers in Northern California	43
5.6	Case Study 2: Transporting Tourists in Cape Churchill	46
5.7	Hydraulic Fracturing in the Marcellus Shale Region in New York	47
5.8	Germline Engineering: A Look into the Future Nexus of Engineering and Biology	51
5.9	Concluding Remarks	54
<b>6</b>	<b>Implications for Engineering Education</b>	<b>55</b>
6.1	A New Paradigm for Engineering Education	55
6.1.1	Living in Peace with Ourselves	55
6.1.2	Living in Peace with Others	56
6.1.3	Living in Peace with the Planet	57
6.2	Accreditation Codes and Modifications	57
6.3	Concluding Remarks	59
<b>7</b>	<b>Final Thoughts</b>	<b>61</b>
	<b>References</b>	<b>63</b>
	<b>Author's Biography</b>	<b>69</b>

# Preface

I have been a professor for nearly 30 years and have taught thousands of students who have pursued careers in engineering. Over the course of the last several decades, I have, as an engineer and an engineering professor, struggled with issues related to the environmental and societal impacts that technology has in the modern world. I have wondered what views of their responsibilities to society and the natural world do students take with them after graduation? Have I given them the tools to make their way in a world in which the natural world is under siege unlike any time before? How will they respond to the poverty and the injustices which dominate so much of our shrinking global society?

Over the course of my career, I have been a faculty member at colleges in the Deep South, the Midwest, and now the Northeast, at large land grant institutions, elite military academies, and small, predominantly liberal arts universities. I have also been a soldier during times of war. Much has changed in engineering education since my formal schooling where we imagined the engineering profession as value free. Today students do not let us get away with such a narrow view of engineering as more and more of them bring to the classroom an awareness of the state of the world's ecosystem as well as poverty and underdevelopment throughout the world. We in engineering can no longer pretend that such issues are for some other profession, not ours.

My sincere hope in writing the present work is to provide a mechanism whereby issues related to the four great challenges that confront us today—security, poverty and underdevelopment, environmental sustainability, and impact upon native cultures—can be discussed in the context of the engineering profession.

When I first wrote this work, I addressed the three challenges that were set out by the Worldwatch Institute, namely security, poverty and underdevelopment, and environmental sustainability. Over the course of the last decade, I have realized that the issues surrounding technology and poverty/development are much more complex than I had first considered. It has become clear to me that the manner in which engineering defined its role was very much linked to our preference for a modern Western lifestyle. It has occurred to me that maybe not all cultures view such a transformation as desirable or healthy. As a result I have included a fourth challenge, one that focuses on the proper and desired goals for the engineering profession while considering the impact on the indigenous peoples throughout the world, although herein the discussion is limited to Native Americans.

George D. Catalano  
August 2014

# Acknowledgments

I am grateful to many who have helped this effort become a reality. My sincerest thanks are extended to my family, my friends, both two-legged and four-legged, and my many students. I am also grateful to the Re-member Organization located on the Pine Ridge Reservation in South Dakota for their efforts on behalf of the Lakota nation and also in awakening me to many of the biases I have had as an engineer. Each has played a part in the development of the ideas that I have put forward. I will remain forever in their debt. Thank you.

*Pax et bene.*

George D. Catalano  
August 2014