

## ENGINEERING and ETHICS<sup>1</sup>

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Engineering is the application of knowledge of physics and chemistry in the conception, development, design, improvement and implementation of mechanical, physical or chemical processes that lead to the creation of products or devices that perform a specific function or goal. Therefore, engineering is always the result of human action. This action may substantiate a technology, but only technologies that create products or devices are engineering.

Ethics refers to the personal dimension of any human action, the way the action emerges from the inner nature of the human being, the values that guide this action.

Therefore, Engineering has always an Ethical dimension.

The application of ethical values to a particular human activity, to be developed in diversified contexts and in specific relation to habits and backgrounds, which are external to the individual, leads to rules that characterize the Moral inherent to each activity. When the activity belongs to a particular professional environment, that professional moral materializes into a Code of Professional Conduct, within which professionals must delimit their performance. Objectives characterize a profession but its identity requires common ideals (a code of ethics) and common standards and rules (a code of professional conduct).

Thinking on ethical values began in ancient Greece and it is a subject of prime concern for society, from which sprang a cumulative proclamation of values that are supposed to be independent of particular or occasional interests or advantages, thus becoming fundamentals of Civilization.

However, the evolution of society accelerated in recent centuries, most especially in science and engineering, and the twenty-first century shows already that this trend will continue on an even faster pace, with contours and implications that are perhaps impossible to identify completely.

Human activities develop in this variable context and under the overwhelming progress of technoscience. Then, it is vital to keep a critical eye on Engineering Ethics, continuously following up developments within each activity and integrating any new ethical values set by society. Anyhow, and whatever are the interests and priorities of the moment, all human activities must have a commitment to timeless ethical principles. Certainly for the benefit of trust and security of mankind but also, with

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<sup>1</sup> This text is a synopsis of Chapter 15 – “Engenharia e Ética” written by the author for the book “Universidade, Ciência e Sociedade: desafios e fronteiras éticas”, edited by Jorge Sequeiros, Universidade do Porto, 2014 – ISBN 978-989-746-037-1, which was already an adaptation of a paper presented by the author as General Report on the Theme “Activity of Structural Engineering”, published in the Proceedings of the Portuguese National Congress on Structural Engineering - Structures 2002, LNEC, Lisbon, 10 to 13 July, p. 3-8, and of the introductory message to the Code of Professional Conduct of the European Council of Civil Engineers ([www.ecceengineers.eu](http://www.ecceengineers.eu)), unanimously approved at the ECCE Plenary Meeting in Rome, 2000. António Adão da Fonseca, who was ECCE President in the 1998-2002 quadrennial, is author of that Code. Both the paper and the introductory message are reproduced in the book “Ethics for Engineers - Challenging the Shuttle Challenger Syndrome”, by Arménio Rego and Jorge Braga, Lidel – Ed. Técnicas, Lda, Lisbon, 2005, p. 152-156.

equal relevance, for protection and freedom of the actors of those activities, so many times facing demands or even abuses of power, including from those elected to interpret Public Good.

In engineering, like in Biotechnology, where these issues present an immense acuteness, knowledge advances powerfully with new forms and abilities that consistently emerge as "faits accomplis" well before society develops a rational process to regulate and eventually establish ethical values and boundaries that must be respected in those actions. An unpleasant consequence of this delay is Ethics often appears as limiting and preventing progress and evolution and not as factor of freedom and happiness for Humanity. Therefore, society needs to anticipate and confront ethical dilemmas that arise and to establish the insurmountable limits of human actions, both in the action itself and in the "modus faciendi" of that same action. Engineers, as builders of civilization, have special responsibilities in preparing themselves for the future and in safeguarding potentially perverse occurrences - for the ability to build walks together with the capacity to destroy.

Ethics and Engineering are always in tension in defining limits of performance and priority of conflicting values. Priority that cannot depend upon opportunistic or sectarian interests.

Many ethical values are not absolute values because if there are conflicts between them and it is not possible to sustain them all simultaneously, priorities and compromises have to be established. Absolute ethical values are those to be upheld in all and any circumstances and without graduations. The unconditional acceptance of these universal values and the acceptance of the need for limits on human actions are indeed indispensable to guarantee the protection of Humanity under the always-possible perversion of power<sup>2</sup>, be it technical, scientific, economic, financial or political, in any conditions or contexts.

Quality of service to society and quality of life achieved ought to be the measures of success and recognition of Engineering.

These goals have to be achieved within a professional environment in constant change, where technoscience develops at high speed, globalization dominates all markets, alarming concentration of economic and financial power is a fact, free movement of people is unstoppable, environment safeguard is a must, security and quality of life are demands, and all that with consequences and implications always greater than anticipated and with direct involvement of society in all processes of decision making. Moreover, very powerful media and information channels, that will be even more dominant in the future, amplify this involvement.

Society needs to believe Engineering takes accurate decisions in the scientific and technical perspective, never neglecting ethical values, whose respect and whose preservation is especially important because the consequences of decisions in engineering are often belatedly known and can be devastating.

This TRUST must be preserved carefully. For that, the highest ethical behaviour of its actors is mandatory.

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<sup>2</sup> Hannah Arendt, *The Origins of Totalitarianism*, New York, Harcourt Brace, 1951.