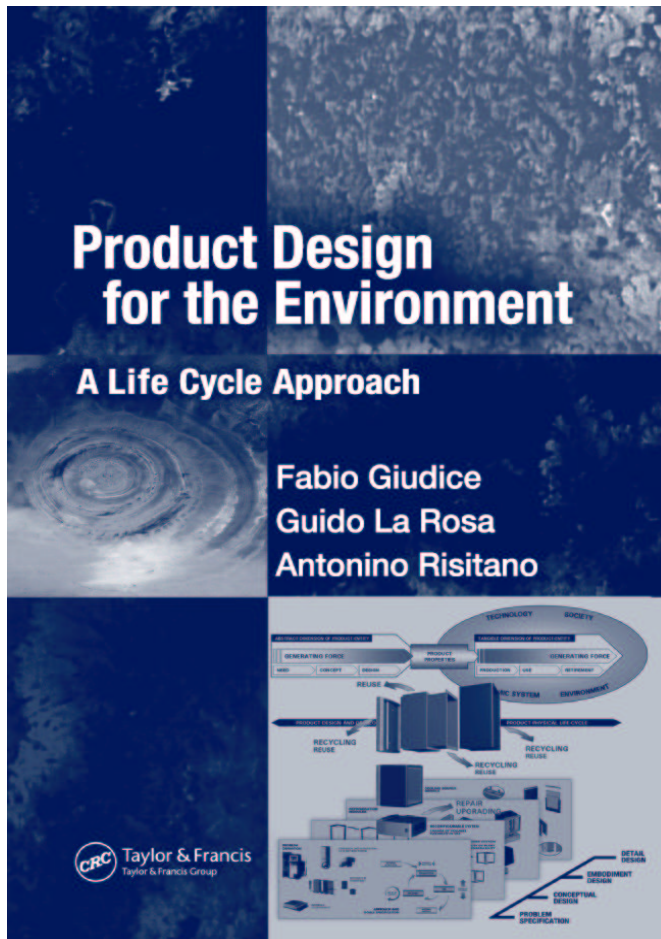


Product Design for the Environment

A Life Cycle Approach

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Increasing awareness of environmental issues has recently materialized in a move toward the optimization of production systems to ensure an elevated level of product eco-compatibility.

This process has led to the development of a new methodological approach to product design, known as *Design for Environment (DFE)*.

According to design for environment approach, the most effective interventions guaranteeing the compatibility of an industrial product with the environment are those undertaken in the first phases of product development. This perspective resulted in *Life Cycle Design (LCD)*, a design intervention which considers all the phases of the product's life cycle (development, production, distribution, use, recovery and disposal) during the entire design process, from concept definition to detailed design development. It therefore uses design methods and tools to integrate product evolution, from conception to disposal, with a wide range of design requirements.

The book focuses on one particular aspect in the field of product design research: the need to develop design methodologies which, by optimizing the physical properties of products (architecture, shapes and geometries, junction systems, parts, materials), ensure an environmentally efficient product life, particularly with regard to useful life and recovery at end-of-life, in order to reduce the consumption of resources and limit all emissions involved in the various sub-processes making up the life cycle.

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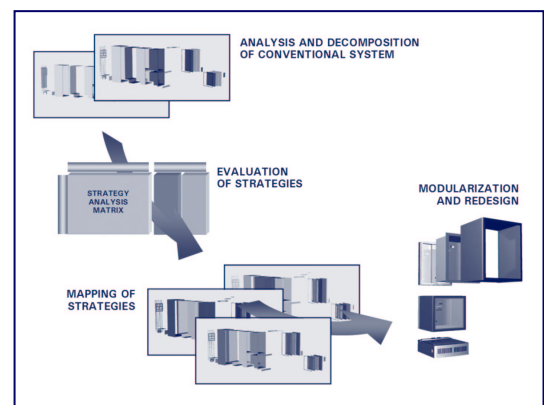
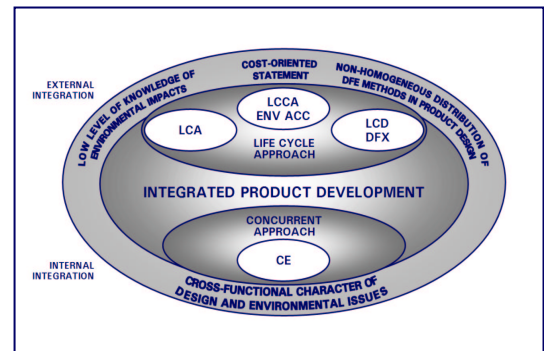
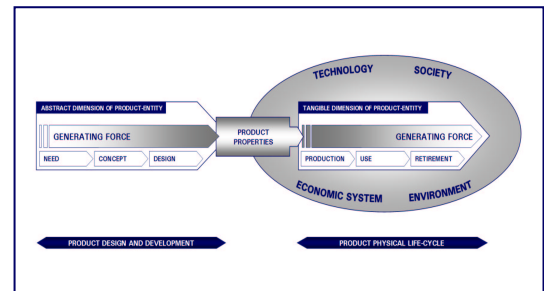
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Structure of the book - It is divided into an introductory chapter and three parts which present main concepts, basic design frameworks and techniques, important themes and related innovative design methods and tools, practical applications.

Having introduced the concepts of *Sustainable Development*, *Industrial Ecology* and *Design for Environment* as defined in the literature, the life cycle theory and approach are presented and applied in **Part I - Life Cycle Approach**, defining the main techniques (*Life Cycle Design and Management*, *Life Cycle Assessment*). This part also considers the bases of *Life Cycle Cost Analysis*, for the full integration of the economic problems in product conception and development.

Part II - Methodological Statement includes the main premises and reference models for the process of product design and development, delineating how it is possible achieve an effective integration of environmental aspects in modern product design. In this context particular attention is given to the strategies which can aid the designer achieve the requisites of eco-efficiency in the various phases of the product life cycle, and to how these strategies are closely correlated to the functional performance of the product and its components, and, therefore, to some aspects of conventional engineering design.

In **Part III - Methods, Tools and Case Studies**, new methods and tools are defined in relation to some issues of *Life Cycle Design* deserving further analysis, given their effectiveness in the design intervention: characteristics of constructional systems and best life cycle strategies, environmental characterization of materials and optimal choice, design for disassembly and optimal disassembly planning, product recovery-cycles planning and cost-benefit analysis, simulation of product life cycle. Each theme is studied in detail, and some original proposals based on the authors' experience are introduced. New concepts and tools are implemented in design practice, demonstrating their use and effectiveness in specific case studies.



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