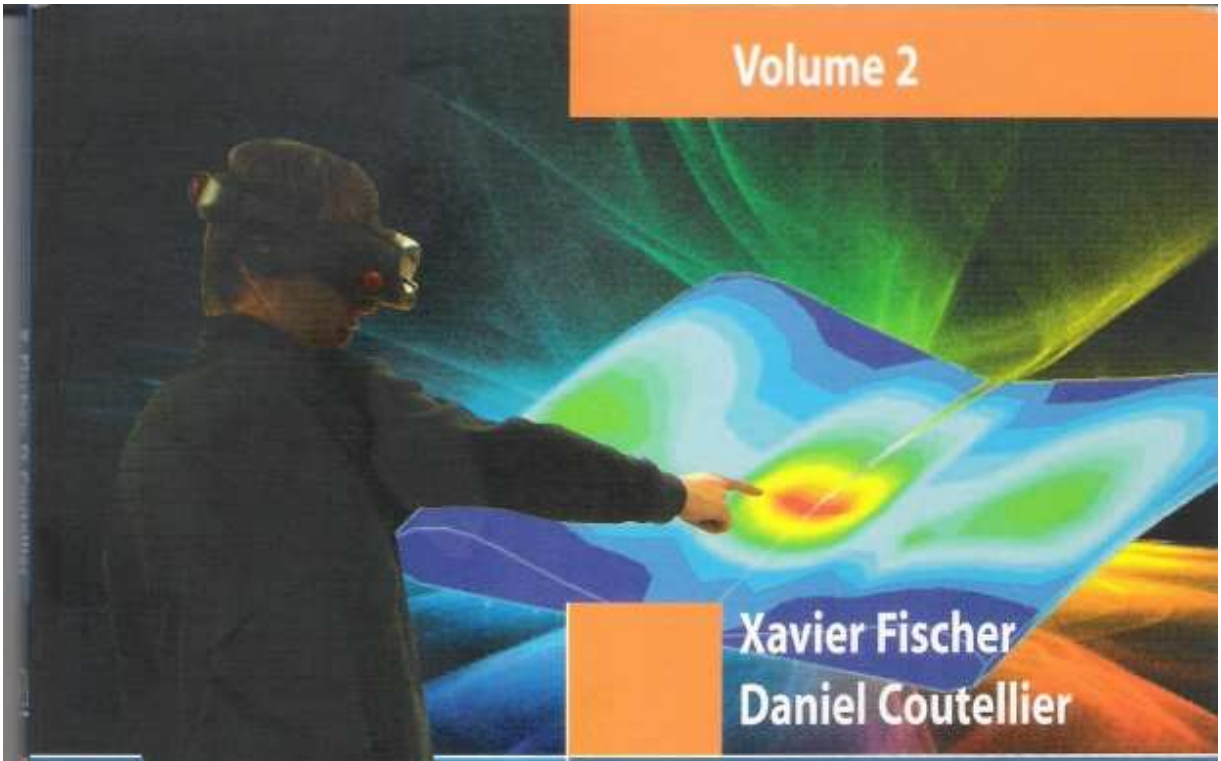
Volume 2



Xavier Fischer
Daniel Coutellier

Research in Interactive Design

virtual concept

ESTIA ECOLE D'INGENIEURS
arts et métiers
Springer
with CD-ROM

Xavier Fischer
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Research in Interactive Design

Springer

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Instructions

Research in Interactive Design - Volume 2 enhances the last successful implementations related to Interactive Methods dedicated to Design and Manufacturing processes. The discussion is detailed and highlighted within:

1. a book: it provides an overview of 200 high-detailed articles,
2. a CD-Rom: it includes 200 articles defining recent achievements in research related to Numerical and mechanical Engineering, Design and industrial studies, High-Realistic Multi-Sensorial Virtual Prototyping and computing technics applied to the development of Interactive Design and Manufacturing methods.

The book provides an abstract of each article referenced and identified according to the following presentation:

Title:	Article Title
Authors:	list of authors
Key Words:	main words defining the topic of the article

Here, an outline of the article is provided through a detailed abstract, wole article being included in the CD-ROM.

Full Text: electronic reference of article within the CD-ROM

Each abstract is linked to a full article included in the CD-ROM retrievable through its electronic reference. In order to read the electronic version of the article, a PDF file reader is required.

The following opening pdf page automatically starts when reading the CD-ROM and allows the reader to reach the well-detailed articles: by clicking on the different titles and following the instructions, the reader can have a direct access to the electronic texts. Electronic support of full documents include an automatic syntaxic searching system.

Partners

Research in Interactive Design integrates the best articles selected by the International Scientific Committee of the International Conference *Virtual Concept 2006*.

Virtual Concept is an International Conference organized and implemented by ESTIA, Ecole Supérieure des Technologies Industrielles Avancées, France.

Designer and Owner

The present book results from a scientific association with the well-known society AIP PRIMECA having international visibility and recognized in the domain of design and manufacturing sciences, partners of Virtual Concept 2006.

The present book and Virtual Concept 2006 are the instruments of AIP PRIMECA.

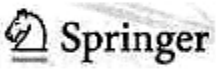
Scientific Certification and Partnership

Virtual Concept 2006 is also scientifically and technically associated to the famous international institution Design Society certifying the relevance of the full articles presented in this book:

Scientific Partners

The present book is developed under partnership with the well-known international publisher Springer Verlag:

Publisher and Partnership



Virtual Concept 2006 is developed and organized with six well-known institutions:

Partners

Research in Interactive Design - Volume 2 has been also supported by Renaud Briand, Christophe Merlo, Patrick Sébastian; as guest co-editors, they have managed the technical publications related to interactive methods respectively developed with Mechatronics, Product Life Cycle and Numerical Modelling techniques.

The present book has been produced by Anaïs Bruzaud.

Foreword

Pr. Daniel Coutellier has started his career as an engineer in charge of CAE analysis software at DATAID AS&I company. In January 1989, he joined the French engineering institute ENSIAME. After being director of studies in ENSIAME, Pr. Daniel Coutellier took his actual post as deputy head and director of International Relations.

Professor in Mechanical Engineering at ENSIAME, Pr. Coutellier is also the general director of the network AIP-PRIMECA that aims to promote the use and the development of integrated design approach in Mechanics and Productics. Chairman of several international congress about design and manufacturing, Daniel Coutellier is quite involved in research close to crash simulation development, and its use as a supporting tool in product design.

Xavier Fischer is an engineer in mechanical engineering and applied Mathematics, qualified by a great French engineering school. After his involvement in Aeronautics industry (SOCATA EADS and Turbomeca) he obtained his PhD in the French engineering school Ecole Nationale Supérieure des Arts et Métiers (centre of research LEPT CNRS UMR 8508).

Author of more than 40 major publications, author and editor of the 2 volumes of the book research in interactive design implemented with Springer Verlag, and invited speaker in around 10 meetings each year, Xavier Fischer intends to regard the problematic of high-realistic multi-sensorial virtual prototyping development for fostering innovation. Since 1997, he focuses on the development of a new perspective of engineering support approach named the Interactive design.

In 2000, he developed the Inverted Integrated Design approach (IDD) that aims to support decision making during the embodiment design stage.

Since 2001, he has extended the concept of IID towards the idea of Interactive Methods. By combining sensorial approach, creativity tools, Virtual Reality Techniques and high-advanced modelling tech-

niques, Xavier Fischer mainly regards how to create new ways for obtaining high-qualified models being able handled in real time for rapid-exploration of design space or for developing human centred design approach based on the use of Virtual Reality techniques. The provided contributions intend to foster creativity by positioning human (design actors or users) in the centre of the design process.

Today researcher in the engineering institute ESTIA, Xavier Fischer manages the Interactive Design research Group. He is also the general chair of the international conference Virtual Concept and the editor in chief of the Springer Verlag International journal IJIDeM (International Journal for Interactive Design and Manufacturing). In charge of international development of research and industrial activities in the new domain of Interactive Design, he supervised a lot of mixed and transversal consortium aiming to strengthen the innovation support tools.

Xavier Fischer maintains relationships with several companies (Dassault Aviation, Ski Rossignol, .etc.) and he is involved in European or French projects, as workpackage leader.

Pr. Daniel Coutellier and Dr. Xavier Fischer are the general Co-Chairs of Virtual Concept 2006. They propose in this book the last discussions about Interactive Design and Manufacturing methods.

Acknowledgement

We wish to start this section by sincerely thanking all the authors for their high-quality contributions integrated within the present manuscript. The scientific and technological survey of *Research in Interactive Design* immediately displays a high-level of maturity of activities that are highlighted through 200 relevant full articles.

Nevertheless, the recognized quality of the proposed discussions is also due to the presence of an International Scientific Committee composed of prestigious researchers. For this, each member of the scientific committee of Virtual Concept 2006 must be gratefully and thankfully highlighted for their involvement.

Moreover, Pr. Georges Fadel, Pr. Grier Lin, Pr. Brian Prasad and Pr. Jannick Roland have also contributed to the visibility of this book. The whole Virtual Concept 2006 organisation gathers itself in order to thank them for their important contributions and support.

We benefit this short section in order to highlight the great involvement of Pr. Bartolo, Dr. Briand, Pr. Cugini, Pr. Di Gironimo, Dr. Merlo, Pr. Moreau, Pr. Ramirez, Dr. P. Sébastian, Pr. Sol and Pr. Kesavadas who have participated to the enhancement of this book by building high-quality special sections focused on in-depth recent studies.

We take advantage of this section to recall the fundamental support of, in order:

- Mr. Jean-Marie Berckmans, Chair of Chamber of Commerce and Industry of Bayonne Pays Basque,
- Mr. Bernard Darretche, General Manager of Chamber of Commerce and Industry of Bayonne Pays Basque,
- Mr. Jean-Roch Guiresse, Manager of ESTIA.

Contents

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Focused Interactive Design Topics

Virtual Concept has labelled some Workshops and Schools in the whole world. Mexico, China, Australia, Brazil and USA have welcomed some Virtual Concept International Preliminary Workshops. From these dynamic organizations, some authors have decided to publish in-depth articles. This section is the report of these focused sights.

Contribution 1

Title:	3D User Interfaces: from Pragmatics to Formal Description.
Authors:	Luciana P. Nedel, Carla M.D.S. Freitas
Key Words:	3D user interfaces, virtual reality, human-computer interaction.

A good matching between input device, interaction technique, the interactive task to be accomplished and system output can help the development of more comfortable, efficient and usable graphics applications. In this article, the process of developing and validating 3D interaction techniques is presented, addressing the selection of devices, the specification of interaction through the use of formalisms, implementation issues and validation. We start reviewing basic concepts of virtual reality, with special attention to 3D interaction techniques. Human-computer interaction concepts needed to develop virtual reality interactive techniques

are also reviewed. Then, the whole process of designing and evaluating a 3D interactive technique is thoroughly analyzed.

Full Article: B1

Contribution 2

Title: A Service Oriented Architecture for a Collaborative Engineering Environment in Petroleum Engineering.

Authors: Ismael H. F. Santos, Alberto B. Raposo, Marcelo Gattass

Key Words: collaborative problem solving environment, SOA, enterprise service bus, scientific workflows.

We discuss the scenario of Petroleum Engineering projects at Petrobras, a large Brazilian governmental oil and gas company. Based on this scenario, we propose an Service Oriented Architecture (SOA) for a Collaborative Problem Solving Environments (CPSE) that we call Collaborative Engineering Environment (CEE) responsible for controlling and executing specialized engineering projects in oil and gas industry. The environment is composed by the integration of three different technologies for distributed group work: Scientific Workflow Management System (ScWfMS), Multimedia Collaborative System (MMCS) and Collaborative Virtual Environments (CVE)

Full Article: B2

Contribution 3

Title: Increasing Reality in Virtual Reality Applications through Physical and Behavioural Simulation.

Authors: Fernando S. Osório, Soraia R. Musse, Renata Vieira,
Milton R. Heinen, Daniel C. de Paiva

Key Words: agent, modelling, Physics, knowledge.

We aim to present new trends, methods and applications related with the interaction of agents and objects present in a Virtual Reality (VR) Environment. In the first part of this tutorial we will discuss about the

introduction of interaction based on physics, including concepts related to perception, action, kinematics and dynamics (including rigid body dynamics, flexible/deformable objects and particles systems). After this discussion about physical interaction between VR agents and elements, then the second part of the tutorial will focus on the behavioural simulation of virtual autonomous agents. We will discuss about different simulation techniques of agent behaviour control, including autonomous agent control architectures (e.g. deliberative, reactive and hybrid architectures). The introduction of knowledge about the agents (e.g. emotional states, personality, personal profile) and about the environment (e.g. special places, functioning rules, place profile), will be also addressed. The knowledge introduced is then used to improve aspects related to the agents autonomy, the interaction within the VR environment, and the degree of reality in the VR simulations. We conclude this tutorial with some examples of practical applications, including recently developed VR applications implemented by our research group.

Full Article: B3

Contribution 4

Title:	Computer Graphics Applications in Virtual Engineering.
Authors:	Alécio Pedro Delazari Binotto, Gino Brunetti, Carlos Eduardo Pereira, Pedro Santos.
Key Words:	virtual engineering, rapid product development, cross-domain engineering, real-time graphics systems.

The application of computer graphics and communication technology in the product development process leads to virtual engineering that, besides excellence in engineering, is becoming a key factor for successful multidisciplinary rapid product development. Virtual engineering tools address the support of cross-domain engineering to integrate the different engineering disciplines and provide a fruitful environment for innovation in products and processes. The advances in virtual engineering are motivated by the global economic competitiveness and, at the same time, by the global alliances built to meet this competition with innovation, collaboration, excellence, quality and shorter development times. In this work, the authors give an overview of the basic concepts of collaborative

virtual engineering present in all phases of innovative product development (from design, to simulation, to maintenance), providing examples for virtual engineering tools and focusing on the importance of real-time systems.

Full Article: B4

Contribution 5

Title: RPD - Rapid Product Development.

Authors: L. Lincoln

Key Words: creativity, rapid design.

Rapid Product Development (RPD) defines an industrial culture that promotes the development of new products and design for production, in scales of time more abbreviated possible. This culture uses new technologies to promote the time reduction, besides the use of 3D, CAD-CAM, Rapid Prototyping, Rapid Tooling, Simulation and the use of Administration Techniques that activate the industrial process.

Full Article: B5

Contribution 6

Title: Virtual Maintenance based Maintainability Analysis System.

Authors: Jianping Hao, Songshan Wang, Liu Hui

Key Words: maintainability analysis, virtual maintenance, maintenance action, virtual maintenance prototype, virtual reality.

It is a challenge for maintainability engineers how to conduct maintainability analysis and find potential design deficiencies in time without building physical mock-up. Virtual reality is an effective way to this problem. We introduce a virtual maintenance based maintainability analysis system (VMMAS) and several key technologies solved during the development of this system such as virtual maintenance prototyping, maintenance action modeling, simulation based maintainability defect analysis and evaluation. Discuss the system implementation and application case.

Full Article: B6

Volume 2

Xavier Fischer
Daniel Coutellier

Research in Interactive Design

Research in Interactive Design Vol. 2 provides an overview of a wide range of original research and engineering activities related to high-realistic multi-sensorial virtual prototyping dedicated to the improvement of industrial innovation.

It is time for usual design and manufacturing support systems to change. Innovation requires industry to have new techniques that enable the rapid emergence of creative ideas, the development of low cost solutions, and the creation of technical consensus immediately to market and economic requirements.

Virtuality should be used as early as possible in the industrial process permitting experts to rapidly explore solution spaces, to accurately study draft solutions in their future environment in a high-realistic way and to assess sketch product efficiency with futur product end-users. Interactive methods, tools and processes respond to these expectations.

Interactive design and manufacturing covers a wide spectrum of multidisciplinary research largely represented in this book where you will find in-depth details related to:

- reduced modelling techniques: a new approach to extended and adaptive behavioural simulation development,
- embedded mechatronic instruments: a new approach multi-sensorial simulation implementation,
- interactive decision making in innovation: a new socio-technical analysis and process.

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In this book, both researchers and industrialists will discover the most recent interactive design techniques, and are certain to walk away with new understanding of important concepts.

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