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Transdisciplinary Engineering: A Paradigm Shift

Proceedings of the 24th ISPE Inc. International Conference on Transdisciplinary Engineering, July 10–14, 2017

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Preface

This book of proceedings contains papers peer reviewed and accepted for the 24th ISPE Inc. International Conference on Transdisciplinary (formerly: Concurrent) Engineering, held at the Nanyang Technological University, Singapore, July 10–14, 2017. This is the sixth issue of the newly introduced series "Advances in Transdisciplinary Engineering", which publishes the proceedings of the TE (formerly: CE) conference series and accompanied events. The TE/CE conference series is organized annually by the International Society of Productivity Enhancement (ISPE, Inc.) and constitutes an important forum for international scientific exchange on transdisciplinary concurrent engineering and collaborative enterprises. These international conferences attract a significant number of researchers, industry experts and students, as well as government representatives, who are interested in the recent advances in transdisciplinary concurrent engineering research, advancements and applications.

Developed in the 80's, the CE approach is based on the concept that different phases of a product life cycle should be conducted concurrently and initiated as early as possible within the Product Creation Process (PCP), including the implications of this approach within the extended enterprise and networks. The main goal of CE is to increase the efficiency and effectiveness of the PCP and to reduce errors in the later phases, as well as to incorporate considerations for the full lifecycle, through-life operations, and environmental issues. In the past decades, CE has become the substantive basic methodology in many industries (e.g., automotive, aerospace, machinery, shipbuilding, consumer goods, process industry, environmental engineering) and is also adopted in the development of new services and service support.

The initial basic CE concepts have matured and have become the foundations of many new ideas, methodologies, initiatives, approaches and tools. Generally, the current CE focus concentrates on enterprise collaboration and its many different elements; from integrating people and processes to very specific complete multi/inter/transdisciplinary solutions. Current research on CE is driven again by many factors like increased customer demands, globalization, (international) collaboration and environmental strategies. The successful application of CE in the past opens also the perspective for future applications like overcoming natural catastrophes, sustainable mobility concepts with electrical vehicles, and intensive, integrated, data processing. Due to the increasing importance of transdisciplinarity, the board of ISPE, Inc. has decided to rename the conference series in "Transdisciplinary Engineering".

The TE2017 Organizing Committee has identified 31 thematic areas within CE and launched a Call For Papers accordingly, with resulting submissions submitted from all continents of the world. The conference is entitled: "Transdisciplinary engineering: a paradigm shift". This title reflects the variety of processes and methods which influences the modern product creation. Finally, the submissions as well as invited talks were collated into 16 streams led by outstanding researchers and practitioners.

The Proceedings contains 120 peer-reviewed papers by authors from 27 countries. These papers range from the theoretical, conceptual to strongly pragmatic addressing industrial best practice. The involvement of more than 15 companies from many industries in the presented papers gives additional importance to this conference.

This book on ‘Transdisciplinary engineering: a paradigm shift’ is directed at three constituencies: researchers, design practitioners, and educators. Researchers will benefit from the latest research results and knowledge of product creation processes and related methodologies. Engineering professionals and practitioners will learn from the current state of the art in concurrent engineering practice, new approaches, methods, tools and their applications. The educators in the CE community gather the latest advances and methodologies for dissemination in engineering curricula, while the community also encourages young educators to bring new ideas into the field.

The proceedings are subdivided into sixteen parts, reflecting the themes addressed in the conference programme:

Part 1 contains papers in the theme Air Transport and Traffic Operations and Management addressing operational management and traffic control issues.
Part 2 contains contributions on Risk-aware Supply Chain Intelligence addressing operational and management issues in client-supplier relationships.
Part 3 illustrates some approaches to Product Innovation and Marketing Management. Papers included in this part address issues, like brand loyalty, consumer readiness, and consumer involvement in innovation processes.
Part 4, Human Factors in Design, an area with growing interest, contains papers on research into, for example, visualization, human behavior with products, and ergonomics.
Part 5, Human Engineering, contains papers, amongst others, on the design of intelligent devices like prostheses.
Part 6 addresses the theme Design Methods and Tools with papers on data and methods for specific design processes.
Part 7 contains papers on the theme Decision Supporting Tools and Methods. In this part subjects like methods and tools for mass customization are addressed including decision-making approaches.
Part 8 deals with the Concurrent Engineering. This part contains various approaches, methods, tools for planning, managing and executing a transdisciplinary engineering process.
Part 9, Knowledge-based Engineering, addresses a variety of approaches to capture, process, manage, use and disseminate knowledge in a transdisciplinary engineering process.
Part 10 is entitled Collaborative Engineering and contains papers on research into methods and tools for the initial phases of the design process in different application areas.
Part 11 contains papers on Engineering for Sustainability: cost-optimal, resource-efficient and eco-design and engineering.
Part 12 contains contributions in the area of Service Design, addressing the notion of systems, as well as the design of service systems and logistics.
Part 13 focuses on Digital Manufacturing with an emphasis on production processes, scheduling, maintenance, and work planning.
Part 14 addresses the topic of Design Automation, addressing topics like modeling automation, process automation, interoperability and data-driven design.
Part 15 contains papers on the theme Artificial Intelligence and Data Analytics with an emphasis on modeling.
Part 16 outlines the importance of Smart Systems and the Internet of Things. Special attention will be given to Cyber Physical Systems, Industry 4.0 and cloud objects.

We acknowledge the high quality contributions of all authors to this book and the work of the members of the International Program Committee who assisted with the blind peer-review of the original papers submitted and presented at the conference. Readers are sincerely invited to consider all of the contributions made by this year's participants through the presentation of TE2017 papers collated into this book of proceedings. We hope that they will be further inspired in their work for disseminating their ideas for new approaches for sustainable, integrated, product development in a multi-disciplinary environment within the ISPE, Inc. community.

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