

# Table of Contents

<b>Preface</b> .....	<b>v</b>
<b>Organization</b> .....	<b>xi</b>
<b>IPS<sup>2</sup> - Keynotes</b>	
<b>Service Cost Estimation Challenges in Industrial Product-Service Systems</b> .....	<b>1</b>
<i>R. Roy, J. A. Erkoyuncu</i>	
<b>The Volkswagen combined Heat and Power Unit - Automotive Know-How for Intelligent Energy Production</b> .....	<b>11</b>
<i>F. Rudolph, H. Manz</i>	
<b>Service Knowledge Management for Product Service Systems – a systems design approach –</b> .....	<b>12</b>
<i>A. Harrison</i>	
<b>Consumable and Expendable Material Support as an Element of Modular Product Service Systems in the Aviation MRO Industry</b> .....	<b>13</b>
<i>M. Mansour</i>	
<b>IPS<sup>2</sup> - Review and Perspectives</b>	
<b>Fan Out of Japanese Service Engineering - the State of the Art -</b> .....	<b>15</b>
<i>Y. Shimomura, K. Watanabe, F. Akasaka, K. Kimita</i>	
<b>Elements of Change in the Transformation towards Product Service Systems</b> .....	<b>21</b>
<i>D. Vladimirova, S. Evans, V. Martinez, J. Kingston</i>	
<b>Research on Services in the Manufacturing Industry based on a Holistic Viewpoint and Interdisciplinary Approach</b> .....	<b>27</b>
<i>T. Sakao, C. Berggren, M. Björkman, C. Kowalkowski, M. Lindahl, J. Olhager, J. Sandin, E. Sundin, O. Tang, P. Thollander, L. Witell</i>	
<b>Product Adaptation for Industrial Product-Service Systems – Characteristics, Motives and Challenges</b> .....	<b>33</b>
<i>S. Biege, M. Schröter, M. Weissenberger-Eibl</i>	
<b>Mechanisms to conduct Life Cycles of Extended Products</b> .....	<b>39</b>
<i>M. Seifert, K.-D. Thoben, J. Eschenbacher</i>	
<b>Towards a Framework for developing Product/Service Systems</b> .....	<b>44</b>
<i>O. Isaksson, T. C. Larsson, P. Johansson</i>	
<b>IPS<sup>2</sup> - Design</b>	
<b>Communicating the Value of PSS Design Alternatives using Color-Coded CAD Models</b> .....	<b>51</b>
<i>A. Bertoni, M. Bertoni, O. Isaksson</i>	
<b>Influences of the IPS<sup>2</sup> Business Model on the Development of a Micro Milling Spindle</b> .....	<b>57</b>
<i>E. Uhlmann, C. Gabriel, N. Raue, C. Stelzer</i>	
<b>Eco-Innovative Design of Product Service Systems by using the Substance-Field Analysis Method</b> .....	<b>63</b>
<i>J. L. Chen, S.-C. Huang</i>	
<b>Case Based Idea Generation Method for Sustainable Businesses</b> .....	<b>69</b>
<i>S. Kondoh, N. Mishima</i>	
<b>Ontology-Based Approach for Supporting Creativity in a PSS Design Methodology</b> .....	<b>75</b>
<i>M. Fulea, S. Brad</i>	
<b>Customer oriented Configuration of Product-Service Systems</b> .....	<b>81</b>
<i>C. Mannweiler, J. C. Aurich</i>	
<b>An Engineering Method for Supporting Customer-Oriented Service Improvement</b> .....	<b>87</b>
<i>F. Akasaka, R. Chiba, Y. Shimomura</i>	
<b>Customer Value Optimization in Product Service System Design</b> .....	<b>93</b>
<i>Y. Tan, X. Chu, Z. Zhang, X. Geng</i>	

<b>Integrating PSS Design Methods with Systems for Customer Value Management and Customer Satisfaction Management ....</b>	<b>99</b>
<i>A. Taabodi, T. Sakao</i>	
<b>Problem Definition in Designing Product-Service Systems .....</b>	<b>105</b>
<i>G. Annamalai, R. Roy, M. Cakkol</i>	
<b>Small Scale Socio-Technical Experiments as Stepping Stones for Eco-Efficient Product-Service Systems Diffusion: a New Role for Strategic Design for Sustainability .....</b>	<b>111</b>
<i>F. Ceschin, C. Vezzoli, P. J. Vergragt</i>	
<b>Towards Sustainability-Driven Innovation through Product-Service Systems .....</b>	<b>117</b>
<i>A. W. Thompson, T. C. Larsson, G. Broman</i>	
<b>A New PSS Conceptual Design Approach Driven by User Task Model .....</b>	<b>123</b>
<i>X. Geng, X. Chu</i>	
<b>Product-Service Systems (PSS) Design Process and Design Support Systems .....</b>	<b>129</b>
<i>Y. S. Kim, S. W. Lee, H. Jin, J. H. Shin, J. A. Park, Y. G. Lee, C. D. Kim, B. H. Seo, S. J. Lee</i>	
<b>Analyzing the Practical Usability of the Heterogeneous Modeling Approach for Conceptual Product-Service System Development .....</b>	<b>135</b>
<i>T. Sadek, M. Köster</i>	
<b>Criteria for assessing the Value of Product Service System Design Alternatives: an Aerospace Investigation .....</b>	<b>141</b>
<i>M. Bertoni, H. Eres, O. Isaksson</i>	
<b>Design of a Product-Service Systems Business Model: Strategic Analysis and Option Generation .....</b>	<b>147</b>
<i>J. Van Ostaeyen, B. Neels, J. R. Duflou</i>	
<b>Integrated Evaluation of a PSS Business Case and a PSS Design Method – Application of the PSS Layer Method to an industrial Drilling Solution .....</b>	<b>153</b>
<i>T. Sakao, S. Paulsson, P. Müller</i>	

## IPS<sup>2</sup> - From Concept to Application

<b>Simulation of Life Cycle Costs of a Product Service System .....</b>	<b>159</b>
<i>G. Lanza, B. Behmann, P. Werner, S. Vöhringer</i>	
<b>Flexible Resource Planning in the Context of Dynamic IPS<sup>2</sup> Business Models .....</b>	<b>165</b>
<i>H. Meier, B. Funke, M. Boßlau</i>	
<b>Learning About Product Service Systems – Conveying Information to Improve the Benefit Evaluation and Stabilize Preferences .....</b>	<b>171</b>
<i>M. Rese, W.-C. Strotmann, M. Karger, J. Gesing</i>	
<b>A Simplified Decision Making Model for Employing Product Service System in Industry at a Preliminary Planning Stage .....</b>	<b>177</b>
<i>R. Khumboon, S. Kara, S. Ibbotson</i>	
<b>Indoor Location Analytics for Designing a Location-Based Product-Service System .....</b>	<b>183</b>
<i>S. K. Kim, J.-W. Ro</i>	

## IPS<sup>2</sup> - Integration and Process Management

<b>Opportunities for enhanced Project Management in PSS Development .....</b>	<b>189</b>
<i>P. Müller, R. Stark</i>	
<b>Toward Establishing Design Methods for Cloud-Based Business Platforms .....</b>	<b>195</b>
<i>S. Hosono, K. Kimita, F. Akasaka, T. Hara, Y. Shimomura, T. Arai</i>	
<b>Sharing Expertise: Easier Said Than Done .....</b>	<b>201</b>
<i>J. Holmqvist, J. Wenngren, Å. Ericson, C. Johansson, P. Thor</i>	
<b>Measuring Innovation Capability – Assessing Collaborative Performance in Product-Service System Innovation .....</b>	<b>207</b>
<i>J. Wallin, A. Larsson, O. Isaksson, T. Larsson</i>	
<b>Descriptive Service Product Architecture for Communication Service Provider .....</b>	<b>213</b>
<i>O. Budde, J. Golovatchev</i>	

## IPS<sup>2</sup> - Knowledge & Information Management

<b>Knowledge Feedback to the IPS<sup>2</sup> Development .....</b>	<b>219</b>
<i>H. Bochnig, E. Uhlmann, R. Gegusch, G. Seliger</i>	
<b>Enhancement in Industrial PSS Design based on TRIZ: a Case Study .....</b>	<b>225</b>
<i>G. Pezzotta, D. Regazzoni, S. Cavalieri, C. Rizzi</i>	
<b>An Ontology for Product-Service Systems .....</b>	<b>231</b>
<i>G. Annamalai, R. Hussain, M. Cakkol, R. Roy, S. Evans, A. Tiwari</i>	
<b>Data Stream Mining for Increased Functional Product Availability Awareness .....</b>	<b>237</b>
<i>A. Alzghoul, M. Löfstrand, L. Karlsson, M. Karlberg</i>	
<b>Industry Practices and Challenges in Using Product in Use Data to Inform PSS Conceptual Design .....</b>	<b>242</b>
<i>R. Hussain, H. Lockett, G. A. Vasantha</i>	

## IPS<sup>2</sup> - Evaluation Methods

<b>Pathways of Servitisation in Mobility Systems .....</b>	<b>249</b>
<i>C. Herrmann, K. Kuntzky, J. Stehr</i>	
<b>Development of an Evaluation Scheme for Product-Service Systems .....</b>	<b>255</b>
<i>K.-J. Kim, D.-H. Lee, C.-H. Lim, J.-Y. Heo, Y.-S. Hong, K.-T. Park</i>	
<b>Economic Relevance of IPS<sup>2</sup> Flexibility .....</b>	<b>261</b>
<i>M. Steven, S. Alevifard, J. Keine genannt Schulte</i>	
<b>Customers' Satisfaction on Estimates of Queue Waiting Time in Service Delivery .....</b>	<b>266</b>
<i>S. Shimada, K. Taira, T. Hara, T. Arai</i>	
<b>Integrating Environmental Assessment Methods: Development of a New Approach .....</b>	<b>272</b>
<i>V. Moreau, N. Gondran, V. Laforest</i>	

## IPS<sup>2</sup> - Business Models and Case Studies

<b>Application of Eco-Services in Automotive Industry for Commercial Customers .....</b>	<b>279</b>
<i>K. Kuntzky, C. Herrmann</i>	
<b>Scenario Management for Sustainable Strategy Development in the Automotive Aftermarket .....</b>	<b>285</b>
<i>U. Dombrowski, C. Engel, S. Schulze</i>	
<b>PSS Contracts for Rail and Road Infrastructure .....</b>	<b>291</b>
<i>S. Lingegård, M. Lindahl, N. Svensson</i>	
<b>A Study on Determination of Upgradability of Laptop PC Components .....</b>	<b>297</b>
<i>K. Mishima, N. Mishima</i>	
<b>A Study on Comparison of Different PSS Concepts Based on Value Creation Efficiency .....</b>	<b>303</b>
<i>Y.-Y. Chun, S. Kondoh, N. Mishima, K.-M. Lee</i>	
<b>An Overview on Degradation Modelling for Service Cost Estimation .....</b>	<b>309</b>
<i>P. Fernandes, R. Roy, J. Mehnen, A. Harrison</i>	
<b>Complexity and Flexibility of IPS<sup>2</sup> Across Various Planning Levels.....</b>	<b>315</b>
<i>H. Meier, M. Steven, B. Funke, M. Boßlau, J. Keine gen. Schulte</i>	
<b>Present Situation of Customer Participation in Service Design and Production - Interviewing Tour Agent, Airline and Elevator Maintenance Company .....</b>	<b>320</b>
<i>T. Koga, T. Hara, Y. Taniguchi, K. Aoyama, T. Arai</i>	
<b>The Smart Real-Time Factory as a Product Service System .....</b>	<b>326</b>
<i>B. Hameed, J. Minguez, M. Wörner, P. Hollstein, S. Zor, S. Silcher, F. Dürr, K. Rothermel</i>	
<b>Business Model Elements for Product-Service System.....</b>	<b>332</b>
<i>A. P. B. Barquet, V. P. Cunha, M. G. Oliveira, H. Rozenfeld</i>	
<b>Organizational Buying Behavior in Case of IPS<sup>2</sup>.....</b>	<b>338</b>
<i>M. Rese, K. Maiwald</i>	
<b>Building a Network of SME for a Global PSS Infrastructure in Complex High-Tech Systems: Example of Urban Applications..</b>	<b>344</b>
<i>A. Lelah, F. Mathieux, D. Brissaud</i>	
<b>Index of Authors .....</b>	<b>351</b>

Functional Thinking for Value Creation  
Proceedings of the 3rd CIRP International Conference  
on Industrial Product Service Systems, Technische  
Universität Braunschweig, Braunschweig, Germany, May  
5th - 6th, 2011  
Hesselbach, J.; Herrmann, C. (Eds.)  
2011, XI, 352 p., Hardcover  
ISBN: 978-3-642-19688-1