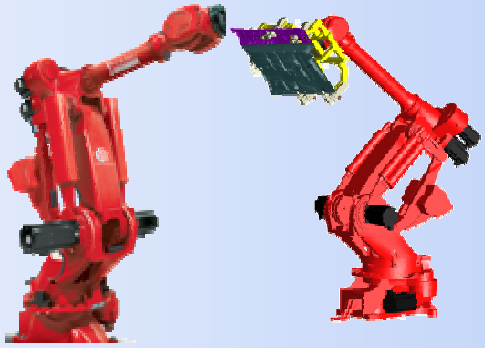

DET 2011

7TH INTERNATIONAL CONFERENCE ON DIGITAL ENTERPRISE TECHNOLOGY

28 - 30 September 2011
Athens

Hosted by:
Laboratory for Manufacturing Systems and Automation
Director Professor G. Chryssolouris
Department of Mechanical Engineering and Aeronautics
University of Patras
GREECE

7TH INTERNATIONAL CONFERENCE ON
DIGITAL ENTERPRISE TECHNOLOGY

PROCEEDINGS OF THE 7TH DET 2011

28 - 30 SEPTEMBER 2011 - ATHENS

ed. by: **Professor G. Chryssolouris**
Professor D. Mourtzis

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Preface

Dear Colleagues:

Welcome to the 7th Digital Enterprise Technology International Conference (7th DET 2011). Digital Enterprise Technology (DET) can be defined as the collection of systems and methods for the digital modeling and analysis of the global product development and realization process, in the context of lifecycle management. The aim of ***DET 2011*** is to provide an international forum for the exchange of leading edge scientific knowledge and industrial experience.

A number of technical papers are presented addressing a wide variety of topics, including Enterprise Modeling and Integration Technologies, Manufacturing Systems and Processes Simulation, Enterprise Resource Planning, Supply Chain Management, Digital Factory, Real-time Decision Making and Decision Support Systems, Complex System Modeling and Analysis, e-Business and e-Commerce, Lean Production and Agile Manufacturing, Flexible and Reconfigurable Manufacturing, Concurrent Engineering, Logistics and Manufacturing Data Management, Virtual Reality and Manufacturing, Web Services and Manufacturing, Life Cycle Design and Manufacturing, Energy efficient and Green manufacturing processes, Environmentally sustainable production systems, Collaborative Manufacturing and Engineering, Rapid Manufacturing, Reverse Engineering, Advanced Metrology, Engineering Education and Training

We wish to thank all of you for your participation, and we hope that you find this conference to be an enriching experience.

Professor G. Chryssolouris
Professor D. Mourtzis
Laboratory for Manufacturing Systems and Automation (LMS)
Chairs, 7th DET 2011

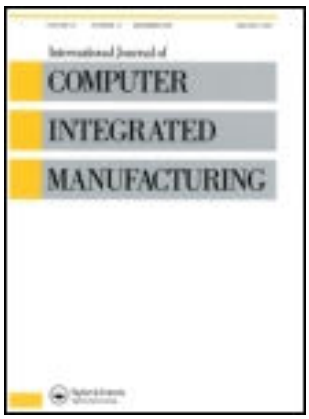
Publication policy:

Selected papers in an enhanced form are being considered for publication in Special Editions of the leading Journals:

1. "International Journal of Computer Integrated Manufacturing"

Guest Editors

Professor George Chryssolouris
University of Patras



2. "Proceedings of IMechE, Part B: Journal of Engineering Manufacture"

Guest Editors

Professor George Chryssolouris
University of Patras

3. "CIRP Journal of Manufacturing Science and Technology"

Guest Editors

Professor George Chryssolouris
University of Patras

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Laboratory for Manufacturing Systems & Automation (LMS)

General Information: The Laboratory for Manufacturing Systems & Automation (LMS) is oriented on research and development in cutting edge scientific and technological fields. LMS is involved in a number of research projects funded by the CEU and European industrial partners. Particular emphasis is given to the co-operation with the European industry as well as with a number of "hi-tech" firms. LMS is under the direction and technical coordination of Professor George Chryssolouris. It currently employs approximately 70 researchers organized in three different groups: Innovative Manufacturing Processes, Advanced Human-Centered Design Techniques, including Virtual Reality, and Production Systems Planning, Control and Networking.

Research

INNOVATIVE MANUFACTURING PROCESSES: LMS is involved in the research and development of innovative manufacturing processes with a high potential for improving quality, productivity, cost and environmental efficiency. Specific fields involve:

- **Laser manufacturing techniques**, including laser drilling, laser cutting, laser process monitoring, 3D laser machining, laser grooving, laser cladding and remote laser welding
- **Rapid Manufacturing**, focusing mainly on Rapid Tooling techniques and new materials
- **Plastics Processing**, including rotational molding
- **Nanomanufacturing and nanomaterial processing**
- **Advanced grinding techniques**, including grind hardening
- **Electro Discharge processes**
- **Micromilling**
- **Roll Forming**
- **Systematic Design**
- **Life-Cycle Assessment**, focusing mostly on Design for Assembly/Disassembly

ADVANCED HUMAN-CENTERED DESIGN TECHNIQUES: LMS is involved in research and development of advanced design techniques in order to support the verification of products and processes in terms of feasibility, functionality, ergonomics and reliability. Specific fields involve:

- **Virtual Reality Applications** industrial applications for process simulation and verification
- **Digital Human Simulation**, including motion capturing and modeling techniques
- **Virtual Collaborative Environments**
- **Ergonomics and safety**, employing prognostic and diagnostic tools (fault tree analysis, decision tools, risk assessment, discomfort evaluation)

PRODUCTION SYSTEMS PLANNING, CONTROL AND NETWORKING: LMS interest is focused on the development, software implementation and use of advanced tools based on Artificial Intelligence methods for production systems planning & control and for the development of intelligent Internet-based applications addressing the enterprise-wide business activities. Specific fields involve:

- **Real-time manufacturing scheduling and production planning**
- **Flexibility in manufacturing systems**
- **Chaos and Time Series Analysis in manufacturing systems**
- **E-business and E-work applications**
- **Supply Chain Management**
- **Model-based quality control procedures**

More than two hundred publications on scientific journals and conferences as well as numerous technical reports have been produced, based on these research activities and are available upon request.

Contact

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Keynote Speakers

1. The role of Simulation in Digital Manufacturing
D. Mourtzis, N. Papakostas, D. Mavrikios, S. Makris, K. Alexopoulos
University of Patras - Greece

2. Web-DPP: An Adaptive Approach to Process Planning and Monitoring
Lihui Wang and Mohammad Givehchi
University of Skövde, 541 28 Skövde, Sweden

Conference Program

7th DET 2011
Conference Program

Tuesday, 27 September, 2011			
17:00 – 19:00	**Onsite Registration**		
19:00 – 20:00	**Reception**		
Day 1: Wednesday, 28 September, 2011			
08:30 - 09:30	**Onsite Registration**		
09:30 – 10:00	**Opening Ceremony** Welcome by Prof. G. Chryssolouris DET Development by Prof. P. Maropoulos Conference Planning by Prof. D. Mourtzis		
10:00 – 10:30	**Keynote Paper** **P22: The role of simulation in digital manufacturing –applications and outlook** D. Mourtzis, N. Papakostas, D. Mavrikios, S. Makris, K. Alexopoulos		
10:30 – 11:00	**Coffee Break**		
11:00 – 12:00	**Session A1**	**Session B1**	**Session C1**
	P01: Economical Analysis for Investment on Measuring Systems M. X. Zhang, P.G. Maropoulos, J. Jamshidi, N. B. Orchard	**P03: Digital Factory Economics** Volkmann, J.; C.Constantinescu	**P11: Planning Software as a Service - A new approach for holistic and participative production planning processes** R.Moch, E.Müller
	P02: Measurement Assisted Assembly and the Roadmap to Part-to-Part Assembly J. Muelaner, O.Martin, A.Kayani, P.G. Maropoulos	**P42: Virtual Rapid Prototyping Machine** E. Pajak, F. Gorski, R. Wichniarek, P. Zawadzki	**P23: A software concept for process chain simulation in micro production** Bernd Scholz-Reiter. J. Jacobi, M. Lutjen

12:00 – 14:00	**Lunch Break**		
	Session A2	**Session B2**	**Session C2**
14:00 – 15:30	**P06: Integrated Large Volume Metrology Assisted Machine Tool Positioning** Zheng Wang, P.G. Maropoulos	**P53: Digital Factory Simulation Tools for the Analysis of a Robotic Manufacturing Cell** A. Caggiano, R. Teti	**P24: An Inventory and Capacity-Oriented Production Control Concept for the Shop Floor based on Artificial Neural Networks** B. Scholz-Reiter, F. Harjes, O. Stasch, J.Mansfeld
	P08: Decision-making for Metrology System Selection based on Failure Knowledge Management Wei Dai, Xi Zhang, P.Maropoulos, Xiaoqing Tang	**P05: Integrated Dimensional Variation Management in the Digital Factory** J E Muelaner, P.G. Maropoulos	**P25: A multi-agent-enabled evolutionary approach to supply chain strategy formulation** Ray Wu**,** David Zhang
	P10: Metrology enhanced tooling for aerospace (META): A live fixturing Wing Box assembly case study O. C. Martin**,** J. Muelaner, Z. Wang, A. Kayani, D. Tomlinson, P. G. Maropoulos, P. Helgasson	**P51: A digital decision making framework integrating design attributes, knowledge and uncertainty in aerospace sector** T. Masood, J.Erkoyuncu, R.Roy, A. Harrison	**P27: Multi-objective Optimization for the Successive Manufacturing Processes of the Paper Supply Chain** M. M. Malik, J. Taplin, M. Qiu
15:30 – 16:00	**Coffee Break**		
	Session A3	**Session B3**	**Session C3**
16:00 – 17:30	**P36: Automation of the three-dimensional scanning process based on data obtained from photogrammetric measurement** R Konieczny, A. Riel, M. Kowalski, W. Kuczko, D. Grajewski	**P56: Viewpoints on digital, virtual, and real aspects of manufacturing systems.** H. Nylund**,** P.Andersson	**P35: Approach for the development of logistics enablers for changeability in global value chain networks** B. Scholz-Reiter, S. Schukraft, M.E. Özsahin
	P55: A Two-phase Instruments Selection System for Large Volume Metrology Based on Intuitionistic Fuzzy Sets with TOPSIS method Bin Cai, J. Jamshidi, P.G. Maropoulos, P.Needham	**P45: Realising the Open Virtual Commissioning of Modular Automation Systems** Xiangjun Kong, B. Ahmad, R. Harrison, Atul Jain, L. Lee, Y.Park	**P29: A multilevel reconfiguration concept to enable versatile production in distributed manufacturing** S. Minhas, M. Halbauer, U. Berger
	P57: Virtual Gage Design for the Effective Assignment of Position Tolerances under Maximum Material Condition G. Kaisarlis, C. Provatidis	**P37: Recommending engineering knowledge in the product development process with Shape Memory Technology** R. Theiß, T. Sadek, S. Langbein	**P04: CORBA Based architecture for feature based Design WITH ISO Standard 10303 Part 224** D. Kretz, J. Militzer, T. Neumann, C. Soika, T. Teich
20:30 – 23:00	**Banquet**		

Day 2: Thursday, 29 September, 2011			
09:30 – 10:00	**Plenary Session** **P46: Web-DPP: An Adaptive Approach to Planning and Monitoring of job-shop machining operations** Lihui Wang, Mohammad Givehchi		
10:00 – 10:30	**Coffee Break**		
10:30 – 12:00	**Session A4**	**Session B4**	**Session C4**
	P54: Diverse noncontact reverse engineering systems for cultural heritage preservation T.Segreto, A. Caggiano, R.Teti	**P15: Virtual Reality enhanced Manufacturing Systems Design** Xiang Yang, R. Malak, C. Lauer, C. Weidig, B. Hamann, H. Hagen, J. C. Aurich	**P40: Frequency Mapping for Robust and Stable Production Systems** R. Schmitt, S. Stiller
	P59: Evaluation of Geometrical Uncertainty Factors during Integrated Utilization of Reverse Engineering and Rapid Prototyping Technologies G. Kaisarlis, S. Polydoras, C. Provatidis	**P62: An Analysis of Human-Based assembly processes for immersive and Interactive Simulation** L.Rentzos**,** G.Pintzos, K. Alexopoulos., D. Mavrikios, G. Chryssolouris	**P64: Knowledge management framework, supporting manufacturing system design** K. Efthymiou, K. Alexopoulos. P. Sipsas, D. Mourtzis, G. Chryssolouris
	P32: A virtual factory tool to enhance the integrated design of production lines R. Hints, M. Vanca, W. Terkaj, E.D. Marra, S. Temperini, D. Banabic	**P60: Knowledge capitalization into Failure Mode and Effects Analysis** G. Candea, C. Candea**,** C. Zgripcea	**P31: Agile manufacturing systems with flexible assembly processes** S. Dransfeld, K. Martinsen, H. Raabe
12:00 – 14:00	**Lunch Break**		
14:00 – 15:30	**Session A5**	**Session B5**	**Session C5**
	P16: Real Options Model for Valuating China Greentech Investments Qin Han**,** L. K. Chu	**P20: Development of a STEP-based collaborative product data exchange environment** Xi Vincent Wang, X. Xu	**P48: A framework for performance management in collaborative manufacturing networks** P. S. Ferreira, P. F. Cunha
	P19: A framework of an energy-informed machining system Tao Peng, X. Xu	**P30: Virtual Factory Manager of Semantic Data** G. Ghielmini, P. Pedrazzoli, D. Rovere, M. Sacco, C.R. Boër, W.Terkaj, G.Dalmaso, F.Milella	**P49: Risk management in early stage of product life cycle by relying on Risk in Early Design (RED) methodology and using Multi-Agent System (MAS)** L. Sadeghi, M. Sadeghi

	P61: Robust design optimization of energy efficiency: Cold roll forming process J. Paralikas , K. Salonitis, G.Chryssolouris	**P63: PROTOTYPE designing with the help of VR techniques: The case of aircraft cabin** L.Rentzos**,** G. Pintzos, K. Alexopoulos, D. Mavrikios, G.Chryssolouris	**P65: A manufacturing ontology following performance indicators approach** K. Efthymiou, D. Melekos, K. Georgoulias, K. Sipsas, G. Chryssolouris
15:30 – 16:00	**Coffee Break**		
16:00 – 17:30	**Session A6**	**Session B6**	**Session C6**
	P17: User - Assisted Evaluation of Tool Path Quality for complex milling processes C. Brecher , W. Lohse	**P69: A pushlet-based wireless information environment for mobile operators in human based assembly lines** S. Makris, G. Michalos, G. Chryssolouris	**P44: A Fuzzy Criticality Assessment System of Process Equipment for Optimized Maintenance Management** Qi H.S., N. Alzaabi, S. Wood, M. Jani.
	P58: Dimensional management in aerospace assemblies: case based scenarios for simulation and measurement of assembly variations P. Vichare, O. Martin, J. Jamshidi, P.G. Maropoulos	**P34: Implementation and Enhancement of a Graphical Modelling Languages for Factory Engineering and Design** C. Constantinescu, G. Riexinger	**P47: Simulation Aided Development of Alternatives for Improved Maintenance Network** A. Azwan, A. Rahman, P. Bilge, G. Seliger
	P68: Machining with robots: A critical review J. Pandremenos, C. Doukas, P. Stavropoulos, G. Chryssolouris	**P18: Implementation of kinematic mechanism data exchange based on STEP** Yujiang Li, M. Hedlind, T. Kjellberg	**P67 : A Web-based Platform for Distributed Mass Product Customization: Conceptual Design** D. Mourtzis, M. Doukas, G. Michalos, F. Psarommatis
Day 3: Friday, 30 September, 2011			
09:00 – 10:30	**Session A7**	**Session B7**	**Session C7**
	P21: Life cycle oriented evaluation of flexibility in investment decisions for automated assembly systems A. Kampker, P. Burggräf, C. W. Potente, G. Petersohn	**P50: Challenges in digital feedback of through-life engineering service knowledge to product design and manufacture** T. Masood, R. Roy, A. Harrison, S. Gregson, Y. Xu, C. Reeve	**P33: Methodology for monitoring and managing the abnormal situation (event) in non-hierarchical business network** A. Shamsuzzoha, S. Rintala, T. Kankaanpää, L. Carneiro, P. Ferreira P. Cunha
	P26: Development of an assembly sequence planning system based on assembly features Hong Seok Park, Yong Qiang Wang	**P66: Structuring and applying production performance indicators** G. Pintzos**,** K. Alexopoulos, G. Chryssolouris	**P41: An automated business process optimisation framework for the development of re-configurable business processes: a web services approach** A. Tiwari, C. Turner, A. Alechnovic, K. Vergidis

	P52: Product To Process Lifecycle Management in Assembly Automation Systems B. Ahmad, I. U. Haq, T. Massod, R. Harrison, B.Raza, R.Monfared	**P14: A novel tool for the design and simulation of Business Process Models** J. Pandremenos, K. Alexopoulos, G. Chryssolouris	**P43: Manufacturing systems complexity an assessment of performance indicators unpredictability** K. Efthymiou, A. Pagoropoulos, N. Papakostas, D. Mourtzis, G. Chryssolouris
10:30 – 11:00	**Coffee Break**		
11:00 – 12:30	**Session A8**	**Session B8**	**Session C8**
	P28: Performance of 3-D Textured Micro- Thrust Bearings with Manufacturing Errors A.G. Haritopoulos, E.E. Efstathiou, C.I. Papadopoulos, P.G. Nikolakopoulos, L. Kaiktsis	**P09: Comprehensive Support of Technical Diagnosis by Means of Web Technologies** M. Michl, J. Franke,. C. Fischer, J. Merhof	**P12: Beyond the planning cascade: Harmonized planning in vehicle production** S. Auer, W. Mayrhofer, W. Sihn
	P38: Kinematic structure representation of products and manufacturing resources M. Hedlind, Yujiang Li, T. Kjellberg, L. Klein	**P70: RFID-Based Real-time Shop-Floor Material Management: An AUTOM Solution and A Case Study** T. Qu, H. Luo, Y. Zhang, X. Chen, G. Q. Huang	**P13: Dynamic wavelet neural network model for forecasting returns of SHFE copper futures price** Li Shi , L. K. Chu, Yuhua Chen
	P07: HSC Machining Centre Basic Errors Prediction For Accuracy Control J. Jedrzejewski, W. Kwasny	**P39: Multi-agent-based real-time scheduling MODEL for RFID-enabled ubiquitous shop floor** T. Qu, George Q. Huang, YF Zhang, S.Sun	
12:30 – 13:30	**Quick Lunch** **END of the Conference**		

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Abstracts

P01: ECONOMICAL ANALYSIS FOR INVESTMENT ON MEASURING SYSTEMS

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ABSTRACT

Metrology processes contribute to entire manufacturing systems that can have a considerable impact on financial investment in coordinate measuring systems. However, there is a lack of generic methodologies to quantify their economical value in today's industry. To solve this problem, a mathematical model is proposed in this paper by statistical deductive reasoning. This is done through defining the relationships between Process Capability Index, measurement uncertainty and tolerance band. The correctness of the mathematical model is proved by a case study. Finally, several comments and suggestions on evaluating and maximizing the benefits of metrology investment are given.

KEYWORDS

Metrology, Measurement, Economical Analysis, Process Capability Index, Statistical Process Control.

P02: MEASUREMENT ASSISTED ASSEMBLY AND THE ROADMAP TO PART-TO-PART ASSEMBLY

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ABSTRACT

Cycle times and production costs remain high in aerospace assembly processes largely due to extensive reworking within the assembly jig. Other industries replaced these craft based processes with part-to-part assembly facilitated by interchangeable parts. Due to very demanding interface tolerances and large flexible components it has not been possible to achieve the required interchangeability tolerances for most aerospace structures. Measurement assisted assembly processes can however deliver many of the advantages of part-to-part assembly without requiring interchangeable parts. This paper reviews assembly concepts such as interface management, one-way assembly, interchangeability, part-to-part assembly, jigless assembly and determinate assembly. The relationship between these processes is then detailed and they are organized into a roadmap leading to part-to-part assembly.

KEYWORDS

Part-to-Part, Measurement Assisted Assembly, Interface management, Fettling, Shimming, One-Way Assembly, Determinate Assembly

P03: DIGITAL FACTORY ECONOMICS

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ABSTRACT

Most factories already have a more or less adequate grasp on what a Digital Factory is, but hardly realise the possible benefits that an implementation may achieve. Still, especially for SMEs, the evaluation of situation based implementation scenarios of digital tools in the context of a Digital Factory is an insurmountable challenge and often keeps potential users from a further investigation. The main challenge is the lack of accepted and appropriate methods and tools to evaluate the economic efficiency, effectiveness and therefore the expected benefits of the employment of integrated digital tools. This evaluation needs to address a selection of digital tools and needs to be scalable to be able to evaluate different alternative implementation scenarios. This paper presents the foundations and the first steps aiming at the development of a scalable methodology for the evaluation and therefore the selection of suitable digital tools.

KEYWORDS

Digital Factory, Digital Tools, DF€, Economics, Process Modeling

P04: CORBA BASED ARCHITECTURE FOR FEATURE BASED DESIGN WITH ISO STANDARD 10303 PART 224

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ABSTRACT

Product design is a fundamental stage of the product lifecycle for the development of new products. The success of a product, efficiency of production planning and manufacturing as well as accruing costs are directly influenced by the decisions of the design engineers and the method of creating product models regarding their further use. Today, especially small and medium-sized enterprises are confronted with a gashed application landscape of incompatible computer systems e.g. for the design, process planning and manufacturing which absolutely hampers an efficient product development. To elaborate a solution for an efficient and integrated product development, we require completely computer-interpretable product design models that provide the entire required information in a standardized form. It is essential that these models support a very flexible data exchange between different application systems as well as the reuse of existing product data and finally a direct collaboration between design and manufacturing engineers together e.g. with expert and assistance systems. This paper provides an insight of our solution to solve these issues by utilizing feature based design with ISO standard 10303 application protocol 224 and the development of a CORBA-based integrated architecture for process and production planning.

KEYWORDS

Computer Aided Design, Product Development, Feature Technology, ISO Standard 10303, Product Model Data Exchange, CORBA

P05: INTEGRATED DIMENSIONAL VARIATION MANAGEMENT IN THE DIGITAL FACTORY

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ABSTRACT

This paper describes how dimensional variation management could be integrated throughout design, manufacture and verification, to improve quality while reducing cycle times and manufacturing cost in the Digital Factory environment. Initially variation analysis is used to optimize tolerances during product and tooling design and also results in the creation of a simplified representation of product key characteristics. This simplified representation can then be used to carry out measurability analysis and process simulation. The link established between the variation analysis model and measurement processes can subsequently be used throughout the production process to automatically update the variation analysis model in real time with measurement data. This 'live' simulation of variation during manufacture will allow early detection of quality issues and facilitate autonomous measurement assisted processes such as predictive shimming.

A study is described showing how these principles can be demonstrated using commercially available software combined with a number of prototype applications operating as discrete modules. The commercially available modules include Catia/Delmia for product and process design, 3DCS for variation analysis and Spatial Analyzer for measurement simulation. Prototype modules are used to carry out measurability analysis and instrument selection. Realizing the full potential of Metrology in the Digital Factory will require that these modules are integrated and software architecture to facilitate this is described. Crucially this integration must facilitate the use of real-time metrology data describing the emerging assembly to update the digital model.

KEYWORDS

Variation analysis, digital factory, measurability

P06: INTEGRATED LARGE VOLUME METROLOGY ASSISTED MACHINE TOOL POSITIONING

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ABSTRACT

The concept of integrating metrology systems into production processes has generated significant interest in industry, due to its potential in reducing production time and defective parts. One of the most interesting methods of integrating metrology into production is the usage of external metrology systems to compensate machine tools in real-time. The development and preliminary experimental performance evaluations of a prototype laser tracker assisted 3 axis machine are described in this paper. Real-time corrections of the machine tool's absolute volumetric error have been achieved. As a result, significant increases in static repeatability and accuracy have been demonstrated, allowing the low cost 3 axis machine to reliably reach static positioning accuracies below 45μm through out the working volume without any prior calibration or error mapping, showing that the proposed methods are feasible, and can have very wide applications.

KEYWORDS

Machine Tool, Metrology, Laser Tracker, Real-time Error Compensation

P07: HSC MACHINING CENTRE BASIC ERRORS PREDICTION FOR ACCURACY CONTROL

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ABSTRACT

The paper deals with the modelling and compensation of the main errors of 5-axis high-speed machining centres and presents a strategy for reducing and effectively compensating thermal errors. A hybrid model of thermal errors and errors caused by high spindle rotational speeds is described. Special attention is given to the modelling of errors arising in the spindle assembly and in the tilting table with direct drives in axes A and C. The conditions which the prognostic modelling of thermal errors must satisfy to ensure the effective compensation of the latter, the error identification methods and the results of compensation by means of the multiregression function are presented.

KEY WORDS

Machine Tool, Error Prediction, Compensation

P08: DECISION-MAKING FOR METROLOGY SYSTEM SELECTION BASED ON FAILURE KNOWLEDGE MANAGEMENT

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ABSTRACT

Decision-making in relation to product quality is indispensable in order to reduce product development risk. Based on the identification of the deficiencies of Quality Function Deployment (QFD) and Failure Modes and Effects Analysis (FMEA), a novel decision-making method is presented that concentrates on a knowledge management network under various failure scenarios. An ontological expression of failure scenarios is presented together with a framework of failure knowledge network (FKN). A case study is provided according to the proposed decision-making procedure based on FKN. The methodology is applied in the Measurement Assisted Assembly (MAA) process to solve the problem of prioritizing the measurement characteristics. The mathematical model and algorithms of Analytic Network Process (ANP) are introduced into calculating the priority value of measurement characteristics, together with an optimization algorithm for combination between measurement targets and measurement systems. This paper provides a practical approach for improved decision-making in relation to quality control.

KEYWORDS

Decision-making in quality control, Failure knowledge management, Decision-making model, Analytic network process

P09: COMPREHENSIVE SUPPORT OF TECHNICAL DIAGNOSIS BY MEANS OF WEB TECHNOLOGIES

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ABSTRACT

Competing in today's production environment requires complex automated production facilities that have to be operated at high efficiency. In order to achieve this, software support for technical diagnosis is necessary in order to ensure quick reaction and troubleshooting in case of failures. This paper presents several system approaches that support efficiently the stages monitoring, diagnosis and therapy by using web technologies. In detail SVG (Scalable Vector Graphics) and VRML (Virtual Reality Modeling Language) based monitoring solutions will be discussed as well as expert systems or multi agent systems that are used during diagnosis and therapy stages. These well-known system concepts that have been pursued for several decades can be enhanced by integrating various web technologies in their realization. This renders them more reusable and user friendly thus making them more efficient and broadly applicable in the field of manufacturing automation.

KEYWORDS

Diagnosis, Monitoring, Web technologies, Expert systems, Scalable Vector Graphics

P10: METROLOGY ENHANCED TOOLING FOR AEROSPACE (META): A LIVE FIXTURING, WING BOX ASSEMBLY CASE STUDY

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ABSTRACT

Aerospace manufacturers typically use monolithic steel fixtures to control the form of assemblies; this tooling is very expensive to manufacture, has long lead times and has little ability to accommodate product variation and design changes. Traditionally, the tool setting and recertification process is manual and time consuming, monolithic structures are required in order to maintain the tooling tolerances for multiple years without recertification. As part of a growing requirement to speed up tool-setting procedures this report explores a coupon study of live fixturing; that is, automated: fixture setting, correction and measurement. The study aims to use a measurement instrument to control the position of an actuated tooling flag, the flag will automatically move until the Key Characteristic (KC) of the part/assembly is within tolerance of its nominal position. This paper updates developments with the Metrology Enhanced Tooling for Aerospace (META) Framework which interfaces multiple metrology technologies with the tooling, components, workers and automation. This will allow rapid or even real-time fixture re-certification with improved product verification leading to a reduced risk of product non-conformance and increased fixture utilization while facilitating flexible fixtures.

KEYWORDS

Dimensional Metrology, Measurement, Tooling, Fixture, Assembly, META

P11: PLANNING SOFTWARE AS A SERVICE - A NEW APPROACH FOR HOLISTIC AND PARTICIPATIVE PRODUCTION PLANNING PROCESSES

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ABSTRACT

The application of planning software for production systems is on the point of changing fundamentally. Technological innovations as Cloud Computing and resulting developments, for instance the rising adaption of Software as a Service license models, offer manifold benefits for enterprises within their software management and establish new possibilities of using software for project driven work. This Paper proceeds from the relation of current software to specific planning phases and processes and reveals possible application scenarios for Planning Software as a Service with a description of the arising chances and risks. On the basis of a modest morphological analysis of software applications, crucial determinants are identified and afterwards valued based on a scenario building. The result is the guidance for adopting Software as a Service in planning phases and processes to support the user effectuating the upcoming change actively with minimized risks.

KEYWORDS

Factory Planning, Cloud Computing, Software as a Service, Web 2.0 Technologies

P12: BEYOND THE PLANNING CASCADE: HARMONISED PLANNING IN VEHICLE PRODUCTION

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ABSTRACT

Medium-term sales and operations and medium to short-term production planning in the automotive industry often employ cascading planning processes. One of the shortcomings of cascading planning is the lack of coordination and feedback between different planning phases. Costly problems in production due to unfeasible production programs and necessary troubleshooting are often caused by unavailable resources or limited supplier capacities, because these restrictions of subsequent levels weren't discovered during the long-term planning. The establishment of a system for the classification of planning restrictions and their originators is the main topic of this paper. In addition, it will highlight the connection between single planning tasks and the correlation of restrictions between different planning horizons. Finally, an experimental setup for implementation approach for such a harmonized system will be presented.

KEYWORDS

Sequencing, Constraint Programming, Integrated Planning, Harmonised Planning

P13: DYNAMIC WAVELET NEURAL NETWORK MODEL FOR FORECASTING RETURNS OF SHFE COPPER FUTURES PRICE

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ABSTRACT

Appropriate forecasting of commodity futures price returns is of crucial importance to achieve hedging effectiveness against the returns volatility risk. This paper presents a nonparametric dynamic recurrent wavelet neural network model for forecasting returns of Shanghai Futures Exchange (SHFE) copper futures price. The proposed model employs a wavelet basis function as the activation function for hidden-layer neurons of the neural network. The aim of this arrangement is to incorporate the fractal properties discovered in futures price return series. In the wavelet transform domain, fractal self-similarity information of the returns series over a certain time scale can be extracted. Input variables are analyzed and selected to facilitate effective forecasting. Statistical indices such as normal mean square error (NMSE) are adopted to evaluate forecasting performance of the proposed model. The forecasted result shows that dynamic wavelet neural network has good prediction properties compared with traditional linear statistical model such as ARIMA and other neural network forecasting models.

KEYWORDS

Wavelet Neural Networks, SHFE Copper Futures, Forecasting, Financial Time Series, Fractal Market

P14: A NOVEL TOOL FOR THE DESIGN AND SIMULATION OF BUSINESS PROCESS MODELS

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ABSTRACT

In this paper, a novel software is presented, serving both as a Business Model (BM) design tool and as a Decision Support System for the measurement and assessment of different BMs, towards specific Key Performance Indicators (KPIs). One of this tool's novelties lies in its capability to easily model and assess BMs that are oriented to Mass Customization (MC), through a set of dedicated functionalities and KPIs. This capability is demonstrated and evaluated through a case study, having stemmed from the shoe industry.

KEYWORDS

Business Model, KPI, Simulation, Mass Customization, software tool

P15: VIRTUAL REALITY ENHANCED MANUFACTURING SYSTEM DESIGN

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ABSTRACT

During the analysis and design of manufacturing systems, enterprises are challenged by existing restrictions and the running production. To deal with these key issues, different virtual factory approaches and tools have been widely implemented in recent years. By mean of such approaches and tools, a manufacturing system can be adapted effectively as changes occur. Virtual Reality (VR), one of the most important approaches, is now applied in scientific and industrial fields. Current studies of VR applications are mainly focusing on the design of products but not manufacturing systems. This paper presents VR as an innovative and collaborative design platform for manufacturing systems, which enables a holistic use of virtual factory tools. Based on this platform, three applications have been implemented, which are addressed at different levels of a manufacturing system. Furthermore, a noise simulation and a virtual machining tool have been visualized in a Cave Automatic Virtual Environment (CAVE).

KEYWORDS

Virtual Reality, Manufacturing System, Virtual Factory Tools, CAVE, Visualization

P16: REAL OPTIONS MODEL FOR VALUATING CHINA GREENTECH INVESTMENTS

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ABSTRACT

The environmental issues of China have attracted global concern. Recent past has witnessed significant investments made in a broad range of greentech businesses – encouraged by significant political and economical drive. Among these, Carbon Capture and Storage (CCS) is considered a promising business. This paper describes a decision problem faced by a firm in determining the optimal timing to invest in a CCS project to reduce CO2 emissions and therefore minimize the purchase of emissions credits. A real options model is developed to simulate the decision process in which the price of emissions credits is assumed to follow a binomial process. It quantized the effect of inflation and depreciation, and worked out the optimal time to invest greentech project. In this model, the firm is assumed to make optimal decisions about a CCS project when the price of emissions credits reaches critical value.

KEYWORDS

Environmental Issues, Real Options, Carbon Capture and Storage, China Greentech Investment, Optimal Timing

P17: USER-ASSISTED EVALUATION OF TOOL PATH QUALITY FOR COMPLEX MILLING PROCESSES

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ABSTRACT

Complex machining technologies such as simultaneous five-axis milling become increasingly significant for today's production industry. Though most existing CAM systems support planning engineers to design these processes, they do not assist in evaluating the quality of resulting NC programs concerning given objectives. Therefore, a new approach presented in this paper is currently developed for identifying potentially critical areas of planned five-axis tool paths. It bases on different criteria aggregating information from process signals and succeeding evaluation functions as part of an inference network. The network interprets fuzzy and crisp rules for computing risk coefficients that specify the inclination of tool paths to different machining deficits such as surface marks, inaccuracy and low productivity. For evaluating machining processes, the inference network demands input data that can be acquired on real and virtual machine tools. The latter must consider effects and interactions of controllers, machines and cutting processes in a co-simulation for providing adequate results. A virtual machine tool covering these requirements has been built up in current research. New findings from this work and its integration into the assistance approach presented before are also described in this paper.

KEYWORDS

CAM Planning, User Assistance, Virtual Machine Tool, Simulation

P18: IMPLEMENTATION OF KINEMATIC MECHANISM DATA EXCHANGE BASED ON STEP

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ABSTRACT

In this paper, the first known valid implementation of kinematic mechanism based on STEP (ISO 10303, STandard for the Exchange of Product data) is presented. The result includes a general conceptual framework and two developed prototype applications. The framework is designed for integration of the STEP-based kinematic mechanism modeling with existing commercial CAx systems. The two applications are implemented for kinematic data exchange between Siemens NX and STEP-NC Machine via STEP AP214 (ISO 10303-214) files. Experiences of design and development of the applications are presented in this paper, and a valid example of data exchange using the developed applications is shown. As the first valid STEP implementation on kinematics, it demonstrates the feasibility of STEP-based data exchange for kinematic mechanism. The research result can also motivate deeper understanding and wider application of the STEP standard in the field of digital factory.

KEYWORDS

Kinematics, CADCAM, STEP, modeling

P19: A FRAMEWORK OF AN ENERGY-INFORMED MACHINING SYSTEM

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ABSTRACT

Sustainable manufacturing is regarded as an essential criterion to advance competiveness of manufacturing enterprises. Energy consumption or energy efficiency of a manufacturing system is one of the key sustainable performance indicators. Monitoring of a manufacturing system requires inclusion of energy information, e.g. total consumption recording and detailed energy-flow tracking in the entire system. Analysis of the gathered energy information in connection with other applications, such as machining parameter optimization, is a necessary step towards energy-informed manufacturing. Based on literature review, a framework of an Energy-informed Machining System (EiMS) is proposed. Machining processes, such as milling, turning, drilling, grinding, are the scope of this research. With a true energy consumption picture, a more efficient, competitive and environmental-conscious production can be achieved. In order to integrate energy information into the CAx chain, STEP/STEP-NC standards are used as the data representation and exchange protocol, giving manufacturing system an intelligent and interoperable nature.

KEYWORDS

Energy consumption, Sustainable machining, STEP/STEP-NC, Optimization

P20: DEVELOPMENT OF A STEP-BASED COLLABORATIVE PRODUCT DATA EXCHANGE ENVIRONMENT

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ABSTRACT:

In a modern manufacturing enterprise, CAD/CAM/CNC solutions are normally provided by various vendors. This forms a heterogeneous application environment. Despite the many integration approaches developed in the last decades, software integration and product data exchanging are still challenging issues that need to be addressed. In this paper, the authors proposed a collaborative product data exchanging mechanism based on a Distributed Interoperable Manufacturing Platform (DIMP). In this platform, STEP (ISO 10303) and STEP-NC (ISO 14649) data formats are utilized to support the data flow. A novel data exchanging mechanism is developed to provide the right amount and level of product data subset to the users.

KEYWORDS

STEP, STEP-NC, interoperable, data exchange, product data sharing

P21: LIFE CYCLE ORIENTED EVALUATION OF FLEXIBILITY IN INVESTMENT DECISIONS FOR AUTOMATED ASSEMBLY SYSTEMS

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ABSTRACT

Due to fast changing market requirements and short product life cycles, flexibility is one of the crucial characteristics of automated and partly automated assembly systems besides purchasing and operation costs. Since the life cycle of an assembly system is longer than the one of the assembled products, flexibility enables an assembly system to adapt to future product requirements as well as production scenarios. The approach proposed in this paper strives for a systematic and economic measurement of flexibility in investment decisions. It offers methods and key-figures supporting the investment decisions for automated assembly systems. The right levels of flexibility and automation of an assembly system are evaluated by using a set of potential future scenarios of the system's life cycle. Based on two new key-figures called Return on Automation and Return on Flexibility, the approach allows comparing different configurations of an assembly system and therefore makes well-informed investment decisions.

KEYWORDS

Assembly System, Flexibility, Decision Making, Life Cycle

P22: THE ROLE OF SIMULATION IN DIGITAL MANUFACTURING – APPLICATIONS AND OUTLOOK

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ABSTRACT

Digital manufacturing technologies have been considered an essential part of the continuous effort towards the reduction in a product's development time and cost as well as towards the expansion in customization options. The simulation-based technologies constitute a focal point of digital manufacturing solutions, since they allow for the experimentation and validation of different product, process and manufacturing system configurations. This paper investigates simulation-based applications in a series of different technological and manufacturing domains. At first, the paper discusses the current industrial practice, focusing on the use of Information Technology. Next, a series of simulation-based solutions are explored in the domains of product and production process design as well as in the area of enterprise resource planning. The current technologies and research trends are discussed in the context of the new landscape of computing hardware technologies and the emerging computing services, including the initiatives comprising both the internet cloud and the internet of things.

KEYWORDS

Information Technology, Simulation, Computer-Aided Design, Computer-Aided Engineering, Computer-Aided Manufacturing, Enterprise Resource Planning

P23: A SOFTWARE CONCEPT FOR PROCESS CHAIN SIMULATION IN MICRO PRODUCTION

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ABSTRACT

Microstructure technology is one of the key technologies of the 21st century. With a higher level of miniaturization, complexity of components and production processes increases. Despite high process uncertainties, micro components require very small manufacturing tolerances. As micro production is characterized by short production times and comparatively long setting-up times, process chain planning becomes an important factor for production efficiency. This article introduces a concept for the simulation of production process chains, which covers fabrication and material flow planning, while addressing process uncertainties and software needs. The main section concentrates on the software concept µ-ProST (µ-Process-chain Simulation Tool), which maintains the workflow and optimizes process chain design, by mapping an already existing methodical model into the software concept. Finally, the article provides an evaluation of this work, by presenting a prototypic simulation of a micro manufacturing decision scenario for a process configuration.

KEYWORDS

micro production, process chain, software concept, logistic size effects, simulation tool

P24: AN INVENTORY AND CAPACITY-ORIENTED PRODUCTION CONTROL CONCEPT FOR THE SHOP FLOOR BASED ON ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

The constantly growing demand for customized and innovative products results in highly complex production processes. The corresponding large workload of the production planning and control systems strengthens the interest in flexible, adaptive and intelligent approaches for both manufacturing systems and the related production control. Methods from the field of artificial intelligence, such as software agents or artificial neural networks, have proven their applicability in this field. This paper presents a production control concept based on artificial neural networks for the inventory and capacity-oriented control of a shop floor. An example demonstrates the overall concept as well as the implementation and performance of the proposed control system

KEYWORDS

Production Control, Shop Floor, Capacity, Inventory, Artificial Neural Networks

P25: A MULTI-AGENT-ENABLED EVOLUTIONARY APPROACH TO SUPPLY CHAIN STRATEGY FORMULATION

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ABSTRACT

This paper presents a research framework for investigating the impact of different supply chain strategies on operational performances of companies, and exploring how such strategies could be formulated in a given competitive environment. Supply chains consist of multiple independent companies with a dynamic relationship of interaction and competition. They appear to be dynamic adaptive systems presenting complex emergent behaviour with uncertainty which causes difficulties for the management to cope with. The research framework employs multi-agent technology and associated systems modelling methods to represent and simulate such interactive and competitive behaviour in a supply chain network. Furthermore, on the basis of the multi-agent simulation platform, an evolutionary approach is developed for identifying best strategies for supply chains operating in different competitive settings. The research will gain further understanding as to how strategies evolve in fast-changing, interactive and competitive situations, which will suggest significant research implications and form practical guidance for industries.

KEYWORDS

Supply Chain Strategy, Software Agent, Simulation, Operational Performance

P26: DEVELOPMENT OF AN ASSEMBLY SEQUENCE PLANNING SYSTEM BASED ON ASSEMBLY FEATURES

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ABSTRACT

To meet the requirements of industries and support manufacturing planners to make decisions rapidly and accurately, the assembly features-based assembly sequence planning system is developed. The system employs a semantic technique for creating an assembly features model. And there are several functional modules in the assembly sequence planning system to make full use of assembly features. In the generation of assembly sequences for any product, the core technologies include the reasoning mechanism for matching assembly features, the algorithm proposed for automatic generation of assembly sequence and the evaluation method for obtaining the optimal assembly sequences. To verify the validity and efficiency of the developed system, the assembly features-based assembly sequence planning is applied to a practical problem, i.e. the assembly of an automotive module such as oil pump and the corresponding results are presented.

KEYWORDS

Assembly Feature Model, Assembly Sequence Planning, Reasoning mechanism, Evaluation Method

P27: MULTI-OBJECTIVE OPTIMIZATION FOR THE SUCCESSIVE MANUFACTURING PROCESSES OF THE PAPER SUPPLY CHAIN

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ABSTRACT

The traditional production focus in the paper industry has been on maximizing machine utilization and minimization of cost but it has had adverse effects on the overall supply chain benchmarks such as over capacity, long lead times, excessive inventory and low customer service. A least cost production plan for the paper manufacturing and conversion stages results in poor cycle service levels where many of the customer orders may fail to meet the due dates. Conversely, a service level maximization approach yields a poor solution with respect to production costs. Therefore, production planning problem in the paper supply chain is faced with more than one optimization criterion which transforms the traditional cost minimization objective into a multiple objective optimization problem with consideration for meeting customer requirements for different grades and the due dates. In this paper, a multi-objective optimization approach to the successive production processes of paper manufacturing and conversion is advocated and applied to obtain a range of compromise solutions between the two conflicting objectives of production cost minimization and maximization of the cycle service levels.

KEYWORDS

Production planning in paper industry, Multi-objective optimization, Genetic Algorithms

P28: PERFORMANCE OF 3-D TEXTURED MICRO- THRUST BEARINGS WITH MANUFACTURING ERRORS

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ABSTRACT

The selection and implementation of proper manufacturing processes is crucial in producing mechanical components that meet the required performance expectations over their lifetime. Manufacturing errors may substantially deteriorate performance, and decrease the lifetime of journal and thrust bearings. Based on recent research, proper texturing may drastically improve the performance of micro- thrust bearings in terms of both load carrying capacity and friction coefficient. In the present work, the performance sensitivity of textured micro- thrust bearings to manufacturing errors is investigated. Here, the bearings are modelled as three-dimensional micro-channels consisting of a smooth moving wall (rotor), and a stationary wall (stator) exhibiting periodic rectangular dimples. Several types of representative manufacturing errors are considered. In particular, discrepancies in the size and shape of the texture geometry, as well as macroscopic errors in the stator surface (concavity/convexity and waviness) are parametrically modelled. The bearing operation is simulated by means of the numerical solution of the Navier-Stokes equations for incompressible isothermal flow. By processing the simulation results, the effects of manufacturing errors on the bearing load carrying capacity and friction coefficient are analyzed, for representative width-to-length ratios. The effects are interpreted by means of pressure distributions and visualization of the flow fields. It is found that, in a number of cases, manufacturing errors result in improved performance of textured micro- thrust bearings.

KEYWORDS

Micro- thrust bearings, CFD, manufacturing errors, performance sensitivity.

P29: A MULTILEVEL RECONFIGURATION CONCEPT TO ENABLE VERSATILE PRODUCTION IN DISTRIBUTED MANUFACTURING

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ABSTRACT

The manufacturing industry is confronting challenges due to high diversity of product variants, reduced product life cycles, short innovation cycles, faster time to market as well as strict environmental regulations. These challenges have persuaded manufacturers to exploit concepts related to open innovation, distributed manufacturing, modular and scalable production system design and eco-efficient production. This paper aims at providing a short review of state of the art in reconfiguration of distributed production systems and focuses on new strategies to resolve complexities that arise subsequently. In this regard, a reconfiguration concept based on new strategic objectives has been proposed to enable customized production. The approach will be implemented and validated in the collaborative projects.

KEYWORDS

Optimization Module, Plug and Produce, Smart Robot Tooling

P30: VIRTUAL FACTORY MANAGER OF SEMANTIC DATA

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ABSTRACT

The growing importance of manufacturing SMEs within the European economy, in terms of Gross Domestic Product and number of jobs, emphasizes the need of proper ICT tools to support their competitiveness. Major ICT players already offer one-does-all Product Lifecycle Management suites, supporting several phases of the product-process-plant definition and management. However, these do also show consistent shortcomings in terms of SME accessibility, degree of personalization and they often lack of an acceptable level of interoperability. These problems are being addressed by the development of a Virtual Factory Framework (VFF), within an EU funded project. The approach is based on four pillars: 1) Semantic Shared Data Model, 2) Virtual Factory Manager (VFM), 3) Decoupled Software Tools that lay on the shared data model and can interact through the VFM, 4) Integration of Knowledge. This paper will focus on the Virtual Factory Manager, proposing an evolution of the former VFF second Pillar (Sacco et al, 2010), that acts as a server supporting the I/O communications within the framework and its stored knowledge for the decoupled software tools needing to access its repository.

KEYWORDS

Virtual Factory, Enterprise Modelling, Reference Model, Interoperability, Semantic Data Model

P31: AGILE MANUFACTURING SYSTEMS WITH FLEXIBLE ASSEMBLY PROCESSES

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ABSTRACT

Traditionally automated manufacturing required high volume and large batches. New technologies for flexible assembly lower the volume requirements and increase the possibilities for product variation. The effectiveness of flexible assembly does however put new demands, but also opens new opportunities, to the manufacturing organisation, the manufacturing logistics chain and the control of material flow. This paper describes two case studies in two Norwegian manufacturing companies. One is a furniture manufacturer for the consumer market; the other is an automotive 1st tier supplier. Both are faced with increasing customisation of products with increased variations and decreased volumes of each individual product. The focus of the research is how the manufacturing organisation and the internal material flow need to adapt to gain from the investment in the flexible automation solutions.

KEYWORDS

Agile Manufacturing, Flexible Assembly, Manufacturing Organisation

P32: A VIRTUAL FACTORY TOOL TO ENHANCE THE INTEGRATED DESIGN OF PRODUCTION LINES

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ABSTRACT

Virtual manufacturing concepts have been adopted by most of the industrial companies, including the small and medium ones, to face the global competition and deal with the top challenges of manufacturing industry, i.e. improving the quality, reducing the delivery time and decreasing the costs. However, most of the virtual manufacturing methodologies, tools and software systems are not integrated well enough to perform the required activities in an efficient manner. The attention is usually focused on local and specific proficiency, thus jeopardizing the sharing of information between the departments, the parallelization of work and the communication along the product or factory life-cycle. Indeed, the transmission of data and results is usually difficult and carried out by means of expensive and/or time-consuming manual work. This paper presents a software tool, named Design Synthesis Module (DSM), to face some of the aforementioned problems by adopting the approach proposed by the Virtual Factory Framework project, consisting in a holistic virtual environment that integrates several decoupled functional tools sharing the same data model to support the design and management of factories. The proposed solution represents one of the tools integrated in VFF and aims at improving the proposal and design phases of production lines in terms of quality, time and cost by supporting the management of production system configuration data across several departments. DSM will support the bidding and system design activities by enabling a quick evaluation of system configurations, easy adjustments and reuse of data, and the concurrent design and integrations with other tools.

KEYWORDS

Virtual Factory, Integrated Design, Concurrent Design, Production Lines, Life Cycle Cost Analysis

P33: METHODOLOGY FOR MONITORING AND MANAGING THE ABNORMAL SITUATION (EVENT) IN NON-HIERARCHICAL BUSINESS NETWORK

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ABSTRACT

Because of substantial impact, potential and value, business collaborations are nowadays turning to be an important issue of contemporary business management. Although business network supports competitive advantages however, it often becomes difficult to manage the integration of the operational processes. During the operational processes there might evolve unexpected situations or events within the network boundary. These events create various obstacles to run the business collaboration smoothly. Monitoring and managing of such abnormal situations create huge challenges for the collaborative firms in respect to production processes. The main objective of event monitoring and management (EMM) is to provide warning and managing any uneven situations that might cause serious damage for the firms. The research presented in this article provides the fundamental concept of EMM that are common in any industrial establishment. A case example is also highlighted within the scope of this paper with the view to demonstrate the ICT-based EMM process, applicable in a non-hierarchical business network.

KEYWORDS

Event Monitoring and Management (EMM), Event Management Ontology, Non-Hierarchical Business Network, Virtual Organization

P34: IMPLEMENTATION AND ENHANCEMENT OF A GRAPHICAL MODELLING LANGUAGE FOR FACTORY ENGINEERING AND DESIGN

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ABSTRACT

The optimal design and permanent adaption of factories guarantees sustainable success and competitiveness in a global economy. Thus factory engineering is a key issue to be addressed. In order to support the engineering of factories a generic and extensible Reference Model for Factory Planning has been developed. The Reference Model is comprised of systemised planning phases and their corresponding planning activities. In this paper different concepts and languages to model the factory planning reference process during the Factory Life Cycle, are presented. Based on the requirement analysis, considering the functionalities of the existing modelling languages, a suitable graphical notation is selected. Furthermore the implementation in the phase of equipment and workplace planning is presented. The requirement of future enhancement of the graphical modelling notation is illustrated and a corresponding roadmap is introduced.

KEYWORDS

Factory Engineering and Design, Reference Model for Factory Planning, Factory Life Cycle, Graphical Modelling Languages

P35: APPROACH FOR THE DEVELOPMENT OF LOGISTICS ENABLERS FOR CHANGEABILITY IN GLOBAL VALUE CHAIN NETWORKS

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ABSTRACT

Recently, logistics networks are increasingly faced with dynamically changing influences in their environment. In order to cope with these volatile trends, flexible adaptations with a short-term horizon are often used, but not sufficient. Rather, a permanent adaption of the network structures is necessary. In this context, our current research deals with the changeability of value chain networks triggered by internal and external influences. The general objective is the development of a methodology for changeable network structures to support or enable necessary changes. With the focus on logistics processes and network elements this paper describes an approach to analyse existing value chain networks and to identify all changeable objects and their specific change drivers. Furthermore, an approach for the development of change enablers and the evaluation of occurring change demands will be presented. The practical applicability of the approach will be assured trough the participation of two industrial partners.

KEYWORDS

value chain network, logistics, changeability, change drivers, change enablers

P36: AUTOMATION OF THE THREE-DIMENSIONAL SCANNING PROCESS BASED ON DATA OBTAINED FROM PHOTOGRAMMETRIC MEASUREMENT

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ABSTRACT

The article presents a general concept of the automation of a three-dimensional scanning process using structured light projection technology. To take measurements, a scanner is moved and positioned in set points by a robot. A cloud of points, representing the scanned object and generated as a result of the photogrammetric measurement process, is used as input data for the creation of the robot control program. A model generated in the process is analyzed by an application which has been developed by the authors and which calculates positions for the industrial robot with a fitted scanner. The described procedure has been tested during measurements of car body parts using a GOM Atos scanner, a Tritop photogrammetric system and a Kuka industrial robot.

KEYWORDS

Reverse Engineering, Photogrammetry, 3D Scanning.

P37: RECOMMENDING ENGINEERING KNOWLEDGE IN THE PRODUCT DEVELOPMENT PROCESS WITH SHAPE MEMORY TECHNOLOGY

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ABSTRACT

Shape Memory Technology (SMT) opens up new approaches to actuators and sensors but a broad application of SMT is hindered by two major issues: First, industrial users lack the necessary knowledge to apply SMT in their products. Second, there is a lack of simplified tools for scientists to make their research findings available to industrial users more easily. Therefore, SMT-specific engineering knowledge has been collected in the "Knowledge and Method base for Shape Memory Alloys" (KandMSMA). An assistance system has been integrated into the KandMSMA which supports scientists on publishing of new content and industrial users on finding relevant content. The article at hand presents an analysis of the initial situation, which led to development of the assistance system and a description of the assistance system itself. Based on this, the article concludes with an evaluation of the usability of the assistance system and an outlook for an enhanced SMT-based product development process.

KEYWORDS

Shape Memory Technology, Product Development, Recommender System, Methodical Support

P38: KINEMATIC STRUCTURE REPRESENTATION OF PRODUCTS AND MANUFACTURING RESOURCES

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ABSTRACT

The basics of kinematic modelling in majority of CAE applications are about to define motion constraints for components relative to other components. The main concepts are links and joints which combined build the topology and geometry of the mechanism. With the additional information about joint type, actuation and motion range, the model provides useful information for motion study. The kinematic structure schema of the standard ISO 10303-105 provides proven capability to represent this information. In the second edition of this standard, currently under development, the granularity and functionality of the model will be increased and further integrated with other parts of the standard ISO 10303. Case studies are presented on utilization of the added capabilities in different applications within product and manufacturing resource representation to illustrate the importance of these features. This paper reports on the author's contribution to this standard.

KEYWORDS

Kinematic, Modelling, Computer aided engineering (CAE)

P39: MULTI-AGENT-BASED REAL-TIME SCHEDULING MODEL FOR RFID-ENABLED UBIQUITOUS SHOP FLOOR

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ABSTRACT

Because of the lack of timely feedback manufacturing information during production execution stage, real-time production scheduling is very difficult to be implemented. In this paper, an overall architecture of multi-agent based real-time scheduling for ubiquitous shopfloor environment is proposed to close the loop of production planning and control. Several contributions are significant. Firstly, wireless devices such as RFID are deployed into value-adding points in a ubiquitous shopfloor environment to form Machine Agent for the collection and processing of real-time shopfloor data. Secondly, Capability Evaluation Agent is designed to optimally assign the tasks to the involved machines at the process planning stage based on the real-time utilization ration of each machine. The third contribution is a Real-time Scheduling Agent model for manufacturing tasks scheduling / re-scheduling strategy and methods according to their real-time feedback. Finally, a Process Monitor Agent model is established for tracking and tracing the manufacturing execution based on a critical event structure.

KEYWORDS

Multi-agent, Real-time Scheduling, Ubiquitous Manufacturing, Auto-ID, RFID

P40: FREQUENCY MAPPING FOR ROBUST AND STABLE PRODUCTION SYSTEMS

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ABSTRACT
Characterized by a complex network of interwoven tasks, time delays, iterations, and rework caused by problems and changes of customer specifications product realization processes are highly dynamic systems. Applying control engineering methods to product realization processes in order to treat its dynamic behaviour can bring a significant benefit for the quality management of these processes. Using its metrics and terms the paper discusses the assignability of the field of control theory for the analysis and design of organizational production processes and order fulfilment. Furthermore it provides an approach towards a description model for quality control loops. Mapping a production system within the frequency domain will facilitate the setup of required control loops and the configuration of a stable and robust production system.

KEYWORDS
Quality Management, product realization, control engineering, discrete state space

P41: AN AUTOMATED BUSINESS PROCESS OPTIMISATION FRAMEWORK FOR THE DEVELOPMENT OF RE-CONFIGURABLE BUSINESS PROCESSES: A WEB SERVICES APPROACH

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ABSTRACT

The practice of optimising business processes has, until recently, been undertaken mainly as a manual task. This paper provides insights into an automated business process optimisation framework by using web services for the development of re-configurable business processes. The research presented here extends the framework of Vergidis (2008) by introducing web services as a mechanism for facilitating business process interactions, identifying enhancements to support business processes and undertaking three case studies to evaluate the proposed enhancements. The featured case studies demonstrate that an increase in the amount of available web services gives rise to improvements in the business processes generated. This research highlights an increase in the efficiency of the algorithm and the quality of the business process designs that result from the enhancements. Future research directions are proposed for the further improvement of the framework.

KEYWORDS

Web service, Business process, Optimisation

P42: VIRTUAL RAPID PROTOTYPING MACHINE

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ABSTRACT

Conventional design techniques do not allow full testing of a device as complex as numerically controlled machine, before physical prototype is created. Doing so requires investing time and money. If designed machine realizes a new process, it is almost impossible to test it and tune its parameters without physical prototype. Paper presents possibilities of using virtual reality to create fully functional virtual prototype of machine for additive manufacturing. The machine itself is a new, innovative device for producing physical prototypes of parts with multidirectional Fused Deposition Modeling process. Basing on CAD model of the 5-axis FDM machine, virtual prototype was created, along with virtual additive manufacturing process. Virtual machine is operated using NC code, prepared basing on product CAD model. Virtual machine can be used to preview the process and to check how various process parameters affect the part quality. Therefore, optimal process parameters can be determined without the physical prototype of the machine. Furthermore, various design aspects can be tested using virtual machine, allowing design verification, also without investing resources into physical prototype.

KEYWORDS

Additive Manufacturing, Rapid Prototyping, Fused Deposition Modeling, Virtual Prototyping,

P43: MANUFACTURING SYSTEMS COMPLEXITY AN ASSESSMENT OF PERFORMANCE INDICATORS UNPREDICTABILITY

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ABSTRACT

In the modern interconnected environment, manufacturing systems, in their pursuit of cost, time and flexibility optimization, are becoming more and more complex, exhibiting a dynamic and non linear behaviour. Unpredictability is a distinct characteristic of such a behaviour and affects production planning significantly. This paper presents a novel approach for the assessment of unpredictability in the manufacturing domain. In particular, the fluctuation of critical manufacturing performance indicators is studied with the help of the Lempel-Ziv Kolmogorov complexity measure in order for the complexity of a manufacturing system to be evaluated. Finally, the method's potentiality is examined with the application of the proposed approach to an automotive industrial use case.

KEYWORDS

Manufacturing complexity, unpredictability, production planning, performance indicators

P44: A FUZZY CRITICALITY ASSESSMENT SYSTEM OF PROCESS EQUIPMENT FOR OPTIMIZED MAINTENANCE MANAGEMENT

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ABSTRACT

In modern chemical plants it is essential to establish an effective maintenance strategy, which will deliver financially driven results at optimized conditions, i.e. minimum cost and time by means of a criticality review of the equipments in maintenance. In this paper a fuzzy logic based criticality assessment system of a local company's equipments is introduced. This fuzzy system is shown to improve the conventional crisp criticality assessment system. Results from case studies show that the fuzzy logic based system can perform the analysis same as the conventional crisp system can do; and in addition, it can outperform, e.g. outputs more criticality classifications with improved reliability and a greater number of different ratings that account for fuzziness.

KEYWORDS

Equipment criticality assessment, Maintenance management, Fuzzy logic

P45: REALISING THE OPEN VIRTUAL COMMISSIONING OF MODULAR AUTOMATION SYSTEMS

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ABSTRACT

To address the challenges in the automotive industry posed by the need to rapidly manufacture more product variants, and the resultant need for more adaptable production systems, radical changes are now required in the way in which such systems are developed and implemented. In this context, two enabling approaches for achieving more agile manufacturing, namely modular automation systems and virtual commissioning, are briefly reviewed in this contribution. Ongoing research conducted at Loughborough University which aims to provide a modular approach to automation systems design coupled with a virtual engineering toolset for the (re)configuration of such manufacturing automation systems is reported. The problems faced in the virtual commissioning of modular automation systems are outlined. AutomationML - an emerging neutral data format which has potential to address integration problems is discussed. The paper proposes and illustrates a collaborative framework in which AutomationML is adopted for the data exchange and data representation of related models to enable efficient open virtual prototype construction and virtual commissioning of modular automation systems. A case study is provided to show how to create the data model based on AutomationML for describing a modular automation system.

KEYWORDS

Modular Automation Systems, Component Based, Virtual Commissioning, AutomationML

P46: WEB-DPP: AN ADAPTIVE APPROACH TO PLANNING AND MONITORING OF JOB-SHOP MACHINING OPERATIONS

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ABSTRACT

Utilising the existing IT infrastructure, the objective of this research is to develop an integrated Web-based distributed process planning system (Web-DPP) for job-shop machining operations and their runtime execution monitoring. Our approach tries to engage a dispersed working group in a collaborative environment, allowing the team members to share real-time information through the Web-DPP. This paper analyses the challenges, and presents both the system design specification and the latest development of the Web-DPP system. Particularly, it proposes a two-tier architecture for effective decision making and introduces a set of event-driven function blocks for bridging the gap between high-level planning and low-level execution functions. By connecting to a Wise-ShopFloor framework, it enables real-time execution monitoring during the machining operations, locally or remotely. The closed-loop information flow makes adaptive planning possible.

KEYWORDS

Process Planning, Machining Feature, Function Block, Job-Shop Machining, Uncertainty

P47: SIMULATION AIDED DEVELOPMENT OF ALTERNATIVES FOR IMPROVED MAINTENANCE NETWORK

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ABSTRACT

The success of organizations operating in complex environments depends on how well their value chain can adapt to disruptions caused by unanticipated events. Building this resilience requires the capability to identify uncertainties and modelling their impact on operations. To effectively achieve this is very difficult. Thus, increasing resilience in maintenance and repair networks calls for an adequate approach to address uncertainties. It is necessary to consider the maintenance activities within and outside the company and those affecting all supplier partners of equipment. This paper presents a comprehensive analysis, a potential approach to model their impact and alternatives to increase the flexibility of the network to ensure profitability and continuity.

KEYWORDS

Simulation, Maintenance, Network

P48: A FRAMEWORK FOR PERFORMANCE MANAGEMENT IN COLLABORATIVE MANUFACTURING NETWORKS

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ABSTRACT

The framework for performance management developed in the Net-Challenge project aims at providing a practical approach to performance management for organisations getting involved in Collaborative Networks. The framework scope comprises objectives and strategy setting, strategy deployment, performance measurement and evaluation, monitoring and improvement. The framework aims at the alignment and achievement of strategic and operational business objectives in the Virtual Organisation and in its supporting Business Community environments. The approach relies on the identification of key stakeholders and on their key success factors which provide the external perspective driving the performance evaluation and improvement. An important component of the framework is the net of performance factors, the drivers of performance, which is identified collaboratively, oriented by the external perspective so that the value for stakeholders is kept in sight. The reference processes for both environments are proposed, connecting all the other framework components.

KEYWORDS

Performance management, Collaborative networks

P49: RISK MANAGEMENT IN EARLY STAGE OF PRODUCT LIFE CYCLE BY RELYING ON RISK IN EARLY DESIGN (RED) METHODOLOGY AND USING MULTI-AGENT SYSTEM (MAS)

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ABSTRACT

Risk assessment and management play a very critical role in design phase of product process. The aim of this article is sustain risk assessment and management during early design phase of product. Indeed the results presented in this work contributes to managing risk during product design phase by development of a computerized system by utilizing the concepts of Multi-Agent System , RED (risk in early design) methodology and rule based intelligent techniques. The suitable decision for design selected according to the acceptable risk. In fact Multi-Agent System helps to facilitate applying RED methodology for risk assessment and management. This paper firstly, describes motivation of this research, context and environment related to this topic. Secondly, a brief state of the art of failure analysis methods is introduced. In the third part, a structured model is proposed for applying RED metrology by utilizing Multi-Agent System. In fact this model is introduced that applies feature-based and parameters design concepts and also Multi-Agent System to handling Risk in Early Design (RED) Method. Then, the results are presented by RMD_MAS_RED tool. Finally, the perspective of this work is presented.

KEYWORDS

Design Phase, Risk in Early Design, Risk Assessment, Risk Management, Multi Agent System

P50: CHALLENGES IN DIGITAL FEEDBACK OF THROUGH-LIFE ENGINEERING SERVICE KNOWLEDGE TO PRODUCT DESIGN AND MANUFACTURE

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ABSTRACT

Even though knowledge management has been a subject of research for a long time, management of through-life service knowledge has started getting more attention quite recently. With the help of literature review and analysis, this paper identifies possible drivers to extend the product life cycle; presents definitions of "knowledge" and "service knowledge", and identifies research gaps and challenges in digital feedback of through-life service knowledge to product design and manufacture. The paper presents a causal loop model to represent causes and effects of through-life service knowledge on product design and manufacture. A digital framework is presented to address challenges in digital feedback of through-life service knowledge to product design and manufacture. The digital framework is developed with the intention of developing a service knowledge backbone demonstrator application. Industrial experts have validated the initial framework. Detailed case studies shall be undertaken to enhance this framework in future.

KEYWORDS

Product design, digital feedback, design for service, through-life engineering service knowledge, manufacturing.

P51: A DIGITAL DECISION MAKING FRAMEWORK INTEGRATING DESIGN ATTRIBUTES, KNOWLEDGE AND UNCERTAINTY IN AEROSPACE SECTOR

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ABSTRACT

The delivery of integrated product and service solutions is growing in the aerospace industry, driven by the potential of increasing profits. Such solutions require a life cycle view at the design phase in order to support the delivery of the equipment. The influence of uncertainty associated with design for services is increasingly a challenge due to information and knowledge constraints. There is a lack of frameworks that aim to define and quantify relationship between information and knowledge with uncertainty. Driven by this gap this paper presents a framework to illustrate the link between uncertainty and knowledge within the design context for services in the aerospace industry. The paper combines industrial interaction and literature review to initially define (1) the design attributes, (2) the associated knowledge requirements, and (3) uncertainties experienced. The concepts and inter-linkages are developed with the intention of developing a software prototype. Future recommendations are also included.

KEYWORDS

Knowledge, design, uncertainty, digital feedback, life cycle.

P52: PRODUCT TO PROCESS LIFECYCLE MANAGEMENT IN ASSEMBLY AUTOMATION SYSTEMS

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ABSTRACT

Presently, the automotive industry is facing enormous pressure due to global competition and ever changing legislative, economic and customer demands. Product and process development in the automotive manufacturing industry is a challenging task for many reasons. Current product life cycle management (PLM) systems tend to be product-focussed. Though, information about processes and resources are there but mostly linked to the product. Process is an important aspect, especially in assembly automation systems that link products to their manufacturing resources. This paper presents a process-centric approach to improve PLM systems in large-scale manufacturing companies, especially in the powertrain sector of the automotive industry. The idea is to integrate the information related to key engineering chains i.e. products, processes and resources based upon PLM philosophy and shift the trend of product-focussed lifecycle management to process-focussed lifecycle management, the outcome of which is the Product, Process and Resource Lifecycle Management not PLM only.

KEYWORDS

Product design, product life cycle, manufacturing process resource, powertrain assembly automation, reconfiguration

P53: DIGITAL FACTORY SIMULATION TOOLS FOR THE ANALYSIS OF A ROBOTIC MANUFACTURING CELL

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ABSTRACT

Modern manufacturing systems need continuous improvement in order to meet the rapidly changing market requirements. A new concept in the field of production engineering has been conceived to optimize manufacturing systems design and reconfiguration: the Digital Factory. This approach is based on the integration of diverse digital methodologies and tools, including production data management systems and simulation technologies. In this paper, the Digital Factory approach is applied to the analysis of an existing manufacturing system dedicated to aircraft engine components production. Different manufacturing cell configurations involving the employment of handling robots are studied through integration of modelling and simulation activities carried out by means of both Discrete Event Simulation (DES) and 3D motion simulation software tools.

KEYWORDS

Digital Factory, Manufacturing Systems, Discrete Event Simulation, 3D Simulation

P54: DIVERSE NON CONTACT REVERSE ENGINEERING SYSTEMS FOR CULTURAL HERITAGE PRESERVATION

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ABSTRACT

Reverse Engineering (RE) is the process of duplicating an existing part, subassembly or product, without drawings, documentation or a computer model. RE is widely employed for applications in areas as diverse as manufacturing engineering, industrial design and cultural heritage. As regards the latter, the use of RE for tangible cultural heritage can be developed for purposes such as reproduction, computer-aided repair, virtual museums, and artefact condition monitoring. Digital data acquisition, i.e. the first stage of the RE procedure, is critical as the choice of the detection methodology can affect the quality of the point cloud and the resulting surface reconstruction or CAD model creation. In this paper, two non contact RE laser systems, respectively based on a coordinate measuring machine and a portable 3D scanning device, are utilised for data acquisition and digital reconstruction of an antique porcelain sculpture of complex geometry to comparatively assess the RE systems performance.

KEYWORDS

Reverse Engineering, Laser Scanning, Cultural Heritage

P55: A TWO-PHASE INSTRUMENT SELECTION SYSTEM FOR LARGE VOLUME METROLOGY BASED ON INTUITIONISTIC FUZZY SETS WITH TOPSIS METHOD

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ABSTRACT

Instrument selection is deemed as a compulsory and critical process in automated inspection planning for large volume metrology applications. The process identifies the capable and suitable metrology devices with respect to the desired measurement tasks. Most research efforts in the past have focused on the probe selection for coordinate measuring machines (CMMs). However, increasing demand for accurate measurement in large scale and complex assembly and fabrication industries, such as aerospace and power generation makes these industries to invest in different measurement systems and technologies. The increasing number of systems with different capabilities create difficulties in selecting the most competent Large Volume Metrology Instrument (LVMI) for a given measurement task. Research in this area is sketchy due to having vast candidates of qualified instruments and at the same time the complexly of understanding their real capabilities. This paper proposes a two-phased approach to select the capable LVMIs and rank the LVMIs according to the pre-defined Measurability Characteristics (MCs). Intuitionistic fuzzy sets combined with TOPSIS method is employed to solve this vague and conflicting multi-criteria problem. A numerical case study is given to demonstrate the effectiveness of the system.

KEYWORDS

Inspection process planning; Measurability characteristics; Large volume metrology; TOPSIS methods; Measurement

P56: VIEWPOINTS ON DIGITAL, VIRTUAL, AND REAL ASPECTS OF MANUFACTURING SYSTEMS

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ABSTRACT

Information and Communication Technology (ICT) plays a key role in improving the efficiency of manufacturing activities. This paper proposes an approach where a manufacturing system is logically divided into digital, virtual, and real existences. The digital and virtual parts present the ICT view where the digital part includes the information and knowledge while the virtual part corresponds to computer models and simulations. Both have their roles in improving the manufacturing activities happening in the real part i.e. producing products and services to customers. These issues are discussed from theoretical aspects explaining structures of manufacturing entities and systems as well as manufacturing activities and improvement. The issues are also explained and demonstrated in a context of an academic research environment.

KEYWORDS

Manufacturing, Digital, Virtual, Improvement

P57: VIRTUAL GAGE DESIGN FOR THE EFFECTIVE ASSIGNMENT OF POSITION TOLERANCES UNDER MAXIMUM MATERIAL CONDITION

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ABSTRACT

Geometric Dimensioning and Tolerancing (GD&T) is currently the dominant approach for design and manufacturing of mechanical components and assemblies. A frequently used geometrical tolerance is the Position Tolerance assigned at the Maximum Material Condition. Recently, due to the progress made in coordinate measuring machines and 3D CAD modellers, the concept of "virtual gage" appeared as an alternative to the traditionally used physical gages. The paper focuses on the implementation rather than the inspection of GD&T specifications in 3D-CAD models of mechanical assemblies by the use of virtual gages. The objective is to provide an easy-to-use CAD-based tool for tolerancing visualisation and functionality analysis during the design phase. The paper extends the utilization of published virtual gage models and investigates their direct implementation on commercially available 3D-CAD environments. Preliminary validation of the proposed approach on the components of a mechanical assembly show promising results in terms of time savings and usability.

KEYWORDS

3D-CAD, Geometrical Tolerances, Dimensional Tolerances, Gages, Simulation

P58: DIMENSIONAL MANAGEMENT IN AEROSPACE ASSEMBLIES: CASE BASED SCENARIOS FOR SIMULATION AND MEASUREMENT OF ASSEMBLY VARIATIONS

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ABSTRACT

In the manufacture of any complex product, the consideration of tolerances and their build up during assembly is vitally important. Tolerances within an assembly are defined during the setting of engineering specifications and in physical terms they arise from the individual components, their manufacturing imperfections, materials and their compliance, the means by which they are fastened and the assembly sequence used. The methodology reported in this paper aims at assessing and predicting the dimensional influence of i) designed tolerances including component and assembly level datum structures using Monte Carlo approach ii) designed assembly processes including assembly sequence, fastening parameters and material compliance using finite element analysis (FEA) methods iii) component and sub-assembly level measurement data for revising assembly sequence if any concessions were issued on manufactured components. Thus, the proposed methodology can be applied before (in the design phase) and during (in the production phase) assembly process execution. The methodology is exploited in the case study for consolidating design, tooling and metrology information to identify how tolerances can be managed more efficiently within an aircraft structure so that the assembly key characteristics can be maintained or improved while component tolerances are relaxed and interface management processes are minimised using measurement assisted assembly techniques.

KEYWORDS

Aerospace Assembly; Assembly Measurement; Tolerance Analysis, Design Verification

P59: EVALUATION OF GEOMETRICAL UNCERTAINTY FACTORS DURING INTEGRATED UTILIZATION OF REVERSE ENGINEERING AND RAPID PROTOTYPING TECHNOLOGIES

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ABSTRACT

Rapid Prototyping Technologies (RPTs) quickly accomplish the realization of concepts related to new product designs. The integration of RPTs with Reverse Engineering (RE) is nowadays widely used in a range of applications, e.g. manufacturing of spare parts, digital reconstruction and fabrication of anatomic structures. For certain applications, the geometrical accuracy of the RE – RP-produced part is critical. Nevertheless, due to inevitable uncertainties introduced in every step of the process, the final component exhibits a variety of geometrical deviations. The paper indicates that despite the advancement in the combined use of digital RE – RP technologies for Rapid Manufacturing (RM) purposes, there are still issues to be considered in application-level before fully achieving the geometrical accuracy potential of RP and RE. Focusing on the evaluation of the geometrical uncertainties during the RP stage of mechanical components' RM process, affecting parameters are identified and to a certain extent quantified through the use of an illustrative case study.

KEYWORDS

Rapid Prototyping, Rapid Manufacturing, Reverse Engineering, Dimensional & Geometrical Accuracy

P60: KNOWLEDGE CAPITALIZATION INTO FAILURE MODE AND EFFECTS ANALYSIS

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ABSTRACT

To achieve high quality designs, processes, and services that meet or exceed industry standards, it is crucial to identify all potential failures within a system and work to minimize or prevent their occurrence or effects. This paper presents innovative usage of knowledge system in Failure Mode and Effects Analysis (FMEA) process. Knowledge system is built to serve multi-projects works that nowadays are in place in any manufacturing or services provider, and knowledge must be retained and reused not only at project level, but also at company level. Collaboration is assured through web-based GUI that supports multiple users' access at any time.

KEYWORDS

Failure Mode and Effects Analysis (FMEA), Decision Support Systems (DSS), Collaborative Work, Case Based Reasoning (CBR), Knowledge Engineering, Knowledge Capitalization

P61: ROBUST DESIGN OPTIMIZATION OF ENERGY EFFICIENCY: COLD ROLL FORMING PROCESS

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ABSTRACT

Cold roll forming is an important sheet metal forming process for the mass production of a variety of complex profiles, coming from a wide spectrum of materials and thicknesses. Energy efficiency is a major trend nowadays, towards the reduction of energy consumption and the better utilization of manufacturing resources. The current paper has proposed a methodology for the robust design optimization of energy efficiency of the cold roll forming process. The energy efficiency indicator is calculated through an analytical model, and the quality characteristic constraints are checked through a model of finites elements. The robust design optimization of the process parameters algorithm is implemented, utilizing the analytical model of energy efficiency, so as to provide a practical approach for determining the optimum set of process parameters, taking into account the variability of noise factors. The current approach is applied to a U-section profile and is practical since it reduces the computational costs and takes into account any uncertainties in a real manufacturing environment.

KEYWORDS

Cold roll forming process, energy efficiency, optimization, robust design, noise factors

P62: AN ANALYSIS OF HUMAN-BASED ASSEMBLY PROCESS FOR IMMERSIVE AND INTERACTIVE SIMULATION

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ABSTRACT

Assembly simulation, with the help of Virtual Reality (VR), becomes a very challenging technology due to its highly interactive context, imposed by a number of functions and the need for realism. This study focuses on the development of an interactive simulation prototype for use in human-based assembly operations. The design aims at improving the easiness and efficiency of VR when used, in the early stages of a product's lifecycle, by engineers that can exploit its benefits, without having an expertise in the VR field. The development of this prototype is tested and evaluated through its implementation on a use case, found in the daily practice of an aerospace industry. The development is made in a platform independent architecture, in order for its possible integration with different VR platforms to be facilitated and it is based on usability guidelines and a taxonomy-based classification. Based on the requirements, provided by the aerospace industry, a validation part is compiled for the evaluation of the interactive prototype developed, in relation to human-centred specifications.

KEYWORDS

Engineering Simulation, Process Simulation, Virtual Assembly

P63: PROTOTYPE DESIGNING WITH THE HELP OF VR TECHNIQUES: THE CASE OF AIRCRAFT CABIN

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ABSTRACT

The main focus of this study is to develop a highly usable immersive environment for virtual aircraft products. The environment should address the modern usability guidelines regarding the design of 3D immersive interfaces. The scope is that the interface mechanisms of virtual environments be approached from an engineering point of view. The development of the environment involves interaction metaphors that will aid a designer or engineer to immersively create and test a product prototype, while exploiting the advantages of VR. In addition, it is important that the user be able to exploit these benefits without being an expert in VR. The development is made in a platform independent architecture in order for a possible integration with other VR platforms to be facilitated. Finally, the proposed interfaces are validated and evaluated based on the aircraft cabin case, using user task scenarios that have been designed for this particular study.

KEYWORDS

Engineering Simulation, Interactive Prototype, Virtual Design

P64: KNOWLEDGE MANAGEMENT FRAMEWORK, SUPPORTING MANUFACTURING SYSTEM DESIGN

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ABSTRACT

Knowledge, in the contemporary economy, represents a fundamental issue. Information is being increasingly distributed across individual workers, work teams and organizations. Therefore, the ability to create, acquire, integrate and deploy knowledge has become a significant organizationalfactor. In particular, estimates suggest that a 55% to 75% of the engineering design activity comprises a reuse of previous design knowledge in order for a new design problem to be addressed. The aim of the current paper is the description of a knowledge management framework, able to support a factory's planning throughout its lifecycle from design to dismantling. The main core of the proposed framework is the ontology stored in the second component of the framework, i.e. the semantics based repository. On top of that, there is another component, the knowledge association engine, being responsible for performing similarity measurements and the inference rule definition and execution. Finally, two use cases, focusing on the design phase, are presented in order to show the applicability of the proposed framework.

KEYWORDS

Knowledge Based Engineering, Ontology, Manufacturing, Key Performance Indicators

P65: A MANUFACTURING ONTOLOGY FOLLOWING PERFORMANCE INDICATORS APPROACH

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ABSTRACT

Ontology can be considered as the core of a knowledge management system, since it provides a formal and explicit description of concepts in a discourse domain. This paper aims at defining a manufacturing ontology, capable of modelling manufacturing systems, with special emphasis being given to four performance indicators, namely cost, time, flexibility and quality. The proposed ontology determines an overall scheme for the description of manufacturing knowledge, including four sub-schemes for the performance indicators, the product, the orders and the plant. The classes of each sub-scheme, their relationships and their attributes are presented in detail. Cost and time assessment rules are defined, enhancing the ontology with reasoning mechanisms, and facilitating the decision making process.

KEYWORDS

Ontology, Manufacturing Systems, Manufacturing Performance Indicators

P66: STRUCTURING AND APPLYING PRODUCTION PERFORMANCE INDICATORS

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ABSTRACT

This study presents a methodology for structuring Production Performance Indicators (PPIs) and their application to different production levels. A number of relevant characteristics, such as hierarchical levels and relative stakeholders are proposed and the indicators can be structurally defined through the use of a PPIs' template. Two main types of indicators that involve near to real time metrics and the calculation of future best practices, for various aspects of a manufacturing system, are investigated, while at application level, the study focuses on PPIs related to the automotive industry. The successful definition and application of these indicators improves the transparency and awareness of the current status of different production steps, while the proposed PPI structure, provides a meaningful comparison of the different manufacturing processes, within a manufacturing firm and across company borders.

KEYWORDS

MANUFACTURING, PRODUCTION INDICATOR, KPI, TEMPLATE, ENERGY EFFICIENCY

P67 : A WEB-BASED PLATFORM FOR DISTRIBUTED MASS PRODUCT CUSTOMIZATION: CONCEPTUAL DESIGN

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ABSTRACT

The currently promoted mass customization paradigm generates complexity in manufacturing and high costs, issues that manufacturers need to address. The work discussed in this paper aims at bridging the gap between mass production and mass customization, by engaging the customer in the design of unique products and by enabling the OEMs to efficiently handle the production by exploiting the benefits of decentralized manufacturing. The conceptual framework presented in this paper is a web-based collaboration platform that consists of a) the user design system which focuses on providing user-friendly design tools that will allow the customer to perform unique design changes, in a controlled way, b) the decentralized manufacturing decision making tool, which allows the systematic generation, evaluation and selection of cost-efficient and eco-friendly manufacturing/supply procedures for the manufacturing of the product and c) the network infrastructure for providing and maintaining the interoperability among the aforementioned systems. The software implementation tools are presented and the expected results from the exploitation of the platform are indicated.

KEYWORDS

Mass customization, user adaptation, decentralized manufacturing, web technologies

P68: MACHINING WITH ROBOTS: A CRITICAL REVIEW

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ABSTRACT

Conventional material removal techniques, namely those of CNC milling, have proven to be able to deal with nearly any machining challenge. On the other hand, the major drawback of using conventional CNC machines is their restricted working area and their produced shape limitations From a conceptual point of view, the industrial robot technology could provide an excellent base for machining that would be both flexible and cost efficient. However, industrial machining robots lack in absolute positioning accuracy, are unable to reject/absorb disturbances, in terms of process forces, and lack in reliable programming and simulation tools so as to ensure right first time machining, at production start-ups. This paper reviews the penetration of industrial robots into the challenging field of machining.

KEYWORDS

Robot, Machining, Accuracy, Programming

P69: A PUSHLET-BASED WIRELESS INFORMATION ENVIRONMENT FOR MOBILE OPERATORS IN HUMAN BASED ASSEMBLY LINES

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ABSTRACT

This paper deals with the wireless manufacturing research topic and discusses the distribution of information in real time using the pushlets / comet technology. RFID based identification techniques are used to track product and operators at the shop floor in real time. This identification triggers the automatic transmission of assembly instructions and multimedia material to handheld or stationary terminals reducing the time required to retrieve and assimilate the information. This paper discusses the architecture design and the implementation aspects of the pushlet-based wireless information environment. The system was validated in a truck assembly line and the findings indicate that its applicability can be extended to other industrial sectors such as the car production, the ship building, aerospace etc.

KEYWORDS

Wireless manufacturing, Flexible assembly, Operator support

P70: RFID-BASED REAL-TIME SHOP-FLOOR MATERIAL MANAGEMENT: AN AUTOM SOLUTION AND A CASE STUDY

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ABSTRACT

Radio Frequency Identification (RFID) technologies provide automatic and accurate object data capturing capability and enable real-time object visibility and traceability. Potential benefits have been widely reported for improving manufacturing shop-floor management. However, reports on how such potentials come true in real-life shop-floor daily operations are very limited. As a result, skeptics overwhelm enthusiasm. This paper introduces an AUTOM solution which provides an easy-to-use and simple-to-deploy framework for manufacturers to implement RFID/Auto-ID enabled smart shop-floor manufacturing process. A real-life case of adopting AUTOM to realize RFID-enabled material distribution in a large air conditioner manufacturer is introduced, aiming to re-vitalize the RFID efforts in manufacturing industries. It is hoped that insights and lessons gained could be generalized for future efforts across household electrical appliance manufacturers in specific and for other types of manufactures in general.

KEYWORDS

Radio Frequency Identification (RFID), air conditioner, manufacturing execution, production management, material distribution.