

---

## Editorial

---

### Angappa Gunasekaran

Department of Management,  
Charlton College of Business,  
University of Massachusetts-Dartmouth,  
285 Old Westport Road,  
North Dartmouth, MA 02747-2300, USA  
Fax: (508) 999-8646      E-mail: [agunasekaran@umassd.edu](mailto:agunasekaran@umassd.edu)

**Biographical notes:** Dr. Angappa Gunasekaran is a Professor of Operations Management in the Department of Management at the Charlton College of Business, University of Massachusetts-Dartmouth (USA). He teaches undergraduate and graduate courses in Operations Management and Management Science. He has 185 papers published in 40 different peer reviewed journals. He has presented over 50 papers and published about 50 papers in conferences and given a number of invited talks in more than 20 countries. He is on the editorial board of over 20 journals. He has organised several international workshops and conferences in the emerging areas of *Operations Management and Information Systems*. He edits journals in the areas of *Operations Management and Information Systems*. He has edited a number of special issues for highly reputed journals. He is currently interested in researching benchmarking, management information systems, e-commerce (B2B), information technology/systems evaluation, performance measures and metrics in new economy, technology management, logistics, and supply chain management.

---

I am pleased to introduce this inaugural issue of the *International Journal of Industrial and Systems Engineering (IJISE)*. *IJISE* proposes and fosters discussion on the theory and application of industrial and systems engineering (ISE). *IJISE* is a refereed journal that acts as a forum and source of information in the field of ISE. This will help professionals, academics, researchers and practitioners working in the field of industrial and systems in emerging economy and society, to discuss the important ideas, concepts, techniques and tools and disseminate information and to learn from each other's work. ISE plays a significant role in improving organisational competitiveness. Hence, there is a need for an integrated ISE strategies, tools and techniques. Considering the globalisation of markets and operations, a journal focusing on ISE is important. Paradigm shift in both manufacturing and services has led to global outsourcing, strategic alliances and partnership in order to be competitive in terms of price, quality, flexibility, dependability and responsiveness. This compels the organisations to develop suitable ISE policies, tools and methods, with the objective of effectively managing the available resources for improving organisational productivity and competitiveness. *IJISE* aims to facilitate the exchange of information on the advances in ISE among researchers and practitioners.

Industrial Engineering is concerned with the design, improvement, and installation of integrated systems of people, materials, information, equipment, and energy. It draws upon specialised knowledge and skill in the mathematical, physical and social sciences, together with the principles and methods of engineering analysis and design, to specify, predict and evaluate the results to be obtained from such systems. Systems engineering deals with the complex interrelationships within a system comprised of people, equipment, materials, information and energy, and examines ways to better design, implement, improve and manage the performance of these integrated systems. Together, as ISE they provide the perfect blend of technical skills and people orientation.

In today's global economy, the most successful engineering managers rely on a combination of technical skills and business principles. ISE aims at imparting fundamental knowledge to develop the ability to address complex industrial issues, emphasising on how to design, run, control and optimise the production systems. The field of industrial engineering embraces a broad spectrum of technical activities including the classical techniques of work methods, production and facilities planning, quality control and safety. It also embraces the fields of human factors, operations research, manufacturing systems, and organisation and management systems. ISE discipline is intellectually challenging, and is blended with the latest quantitative tools from a systems perspective of solving problems. The real challenges of ISE professionals are to develop new principles, tools, techniques and applications of ISE to enhance their active role in the 21st century global market and enterprises. To maintain the journal's breadth of focus in research, fields of operations research and human factors/ergonomics and a specific need for stochastic processes or simulation, and sensation/perception will be considered. *IJISE* will have a strong methodological approach and application focus of ISE that will concentrate on logistics, health care systems, human-computer interaction, bioinformatics and biotechnology, nanotechnology, and other promising crossdisciplinary fields.

The main objective of the journal is to provide a platform for interaction between researchers and practitioners who are dealing with ISE theory and applications. It also aims to promote and coordinate developments in the field of ISE. Systems perspective is emphasised with the objective of developing new ISE concepts and technologies to meet the needs of organisational changes in the global e-markets. *IJISE* will provide executives and academics with state of the art of ISE theory and applications.

This inaugural issue of *IJISE* contains 14 papers, discussing a wide range of issues dealing with industrial and systems engineering issues. While no unifying theme for the papers exists, each makes a unique contribution to the extant literature in the field. A brief overview of the 14 papers is provided below.

Healthcare is one of the largest industries in the developed world and the top domestic industry in the USA. Over the past 30 years there has been a dramatic increase in the cost of healthcare in the USA, of which about one third can be attributed to hospital spending. One of the key factors in hospital cost containment and revenue enhancement is effective and efficient bed planning. Cochran and Bharti in their paper, 'A multi-stage stochastic methodology for whole hospital bed planning under peak loading', propose a multi-stage stochastic methodology for bed planning in hospitals. The methodology aims to balance inpatient bed unit utilisations in an entire hospital to minimise the blocking of beds from upstream units within given constraints on bed reallocation while considering different patient types. A 400 plus bed major hospital is analysed with the methodology. Queuing network analysis and optimisation are first used to achieve balanced targets of bed unit utilisation while building hospital staff involvement. Discrete-event

simulation is then used to maximise the flow through the balanced system including nonhomogeneous effects of peak loading, nonexponential lengths of stay, and blocking behaviour. The results of the study provide a valuable insight into largescale hospital system dynamics and enable planners to better utilise bed capacities in hospitals under their environment of uncertainty, variability, and limited resources.

The paper, 'Concurrent Engineer-To-Order operation in the manufacturing engineering contracting industries', by Chen defines the concept of concurrent engineer to order (ETO) operation and presents a foundation for the design and development of an effective concurrent ETO operation system. Concurrent ETO is a make-to-order operation that starts with a product specification and finishes with delivery of a customised product. It synchronises the operations of an integrative product development process that effectively minimises and assures product development lead time, by applying the concepts of concurrent engineering, mass customisation and lean manufacturing. A concurrent ETO operation framework is proposed to explain the interactions among various activities in the sales, engineering, material acquisition and manufacturing processes. The framework focuses on hierarchical planning, incremental scheduling and operation control.

The paper, 'Modelling and analysis of supply chain dynamics: a High Intelligent Time (HIT) petri net based approach', by Jain, Wadhwa and Deshmukh proposes a generic modelling and analysis approach that integrates functions, captures all processrelated information, including activities, resources and organisational units as well as their interdependencies to support complex dynamics and distributed supply chain processes. In this paper, they model and analyse the dynamics associated with two supply chain production planning and control policies, viz. the make-to-stock (MTS) and the assemble-to-order (ATO) by a High Intelligent Time (HIT) petri net. The proposed model takes into account both the delivery logistics and the procurement course of action that exists between any two members of the supply chain. The HIT model serves as both an inference model for rulebased systems and a platform for knowledge verification and validation. The HIT model provides the availability of timely information across the various stages of the supply chain and effectively utilises the information for improved performance.

Wang and Perkins in their paper, 'Using interval alignment policies for efficient production control of supply chain systems', discuss a class of interval alignment (IA) policies, which result in the development of a new methodology for detailed scheduling in supply chain management systems. The use of takt times and the Just-in-Time philosophy in lean manufacturing have become prevalent; much effort has been put into removing variability in material flows. It has been demonstrated that the proposed IA policies, by adding intermediate delays to the system, effectively smoothen the flow of parts, improve performance, and decrease average Work-in-Process and production lead times. Also discussed are the applications of IA policies in work cell design in supply chain systems and the implementation of IA policies using Kanban controls.

Innovation provides the solution for enterprises to survive and grow in the 21st century competitive environment. Due to the distributed and heterogeneous characteristics of innovation, it is difficult to manage the innovation process effectively across the extended enterprise. The emerging and rapid development of semantic web technologies brings new opportunities to manage innovation across extended enterprises comprising many organisations. In their paper, 'Semantic innovation management across the extended enterprise', Ning, O'Sullivan, Zhu and Decker introduced a novel vision for

Semantic Innovation Management (SIM). The system architecture combines ontology, inference and mediation technologies used to create a semantic web of innovation knowledge. A functional framework of the SIM System (SIMS) based on metadata harvesting and RDF data access technologies is presented. An applied SIMS case study implemented by using semantic web software is explained in detail.

Chantarat, Allen, Ferhatosmanoglu and Bernshteyn in their paper, 'A combined array approach to minimise expected prediction errors in experimentation involving mixture and process variables' propose methods to reduce prediction errors, including the use of a criterion that is the expected squared value of these errors, taking into account bias, and the application of alternative candidate sets. They compare the proposed methods with alternatives using case studies from the literature. They show how computer generated combined arrays based on the combined models can be expected to yield lower prediction errors compared with relevant alternative experimental plans, including design methods combining central composites and simplex centroids and D-optimal block designs.

The paper, 'Policy evaluation for storage and retrieval of loose cargos in air cargo terminals', by Huang, Chew and Mok addresses storage assignment policies for loose cargos that need to be stored temporarily in an automated storage system and retrieved later for buildup in an actual export air cargo terminal. Standard size bins are used to store loose cargos in various sizes as they are lodged in. The storage assignment is concerned with how cargos of different flights are assigned to the bins. A quantitative model is developed to evaluate the effectiveness of a current policy and some proposed policies in which flights are grouped according to a few time zones and cargos are assigned to bins associated with the respective groups. It is shown that the proposed policies significantly reduce the expected number of handlings as well as the duration of the average cycle time of the bins.

Cognitive engineering is an interdisciplinary area of research and practice concerned with the analysis, design, and evaluation of complex sociotechnical systems. As such, it differs from other disciplines that are also concerned with people-technology interaction (e.g., ergonomics, human factors engineering, human-computer interaction). Vicente in his paper, 'Cognitive engineering: a theoretical framework and three case studies' argues that there is a good fit between the intellectual toolbox of cognitive engineers and the challenges faced by ISE practitioners and researchers. This thesis is illustrated by three case studies showing how a particular cognitive engineering concept – Rasmussen's framework for risk management – can address a diverse set of issues that are of central importance to ISE: analysis of adverse events, development of cumulative, unified knowledge and understanding organisational change.

Manufacturing facility layout is determined by minimising the material handling cost associated with the manufacture of products. A manufacturing facility operates in a dynamic environment where the production rates and product mix are continuously changing. Hence, it is often necessary to analyse and redesign the layout. Existing methods for the analysis of redesign use multiple, static, and tabular from-to charts. Krishnan, Cheraghi and Nayak in their paper, 'Dynamic From-Between Chart: a new tool for solving dynamic facility layout problems', developed a new tool, 'Dynamic From-Between Chart', that allows easier visualisation of the changes in product rates and mix. This new tool models the production rate changes, using a continuous function. The solution methodology uses a tradeoff analysis between increased material handling costs with rearrangement costs for redesign of layouts.

With today's fast paced technological advancements, flexibility has emerged as a strategic imperative for the viability of business enterprises. This realisation has stimulated considerable research interests in the area of flexibility, most of which have focused on defining flexibility, its attributes and its measurements. However, central to the success of any flexibility initiative, are the design and allocation of available resources across its various classes to match the uncertain future needs of the organisation. Abdel-Malek, Areeratchakul and Otegbeye in their paper, 'Designing for manufacturing flexibility: a newsvendor approach' extend the classical newsvendor problem to optimise the selection of equipment to correspond with the uncertain flexibility needs. More specifically, their model is designed to capture the uncertain nature of the requirements for various flexibility classes vis à vis their associated utility to determine the optimum (appropriate) level of investment in each. A numerical example is included to show the application of the developed model and its suitability in system design.

The paper, 'High performance manufacturing of complex surfaces using inverse cutting profiles and NC verification of virtual models', by Ren, Lee and Wang presents an Inverse Cutting Profile (ICP) method to construct Generalised CL (GCL) surfaces with generalised endmill cutters for high performance machining of polyhedral models. The inverse cutting profiles are constructed as the silhouettes of an inverse cutter projected from the tool's instantaneous cutting direction. By utilising the inverse cutting profiles, Generalised CL (GCL) surfaces can be generated by the swept envelope of the inverse tool moving along the part surface. Accurate tool paths are generated by slicing the constructed GCL surfaces with guide planes. Techniques of NC verification based on the virtual simulation model are also presented in this paper.

The shifting bottleneck (SB) heuristic has been successfully applied to the jobshop scheduling problem. In their paper, 'The shifting bottleneck procedure for jobshops with parallel machines', Chen, Lee, Pulat and Moses extend the shifting bottleneck heuristic to solve jobshop problems with parallel machine workcentres. The efficient shifting bottleneck heuristic is developed to reduce the number of subproblems and provide tradeoff results between the computation time and the solution quality. The effect of bottleneck machine selection and reoptimisation procedures on the computational time is discussed.

In pharmacy operations, multiple pharmacists and technicians may process a single prescription. The process may be interrupted several times because of the need to interact with patients and take phone calls. The number of prescriptions needing processing fluctuates significantly during different time periods. These factors make it very difficult, if not impossible, to apply the traditional time study approach in measuring pharmacy operation efficiency. To deal with this problem, Lin and Huang in their paper, 'A continuous sampling approach to pharmacy operation efficiency study' developed a continuous sampling approach based on video recording technology to comprehensively measure pharmacy operation efficiency. They conducted their study at eight sites of a major chain drugstore pharmacy and determined and analysed current operation efficiency to identify opportunities for performance improvement.

Cost estimation at the design stage is necessary to optimise the product design. The paper, 'Feature-based cost estimation for composite structures with Fuzzy Multiattribute Utility Theory' by Zhao, Li, Zhang, Liang and Wang presents a cost estimation model for the design and manufacturing of composite structures. The model, known as the Fuzzy Multiattribute Utility, combines Multiattribute Utility Theory and

Fuzzy Logic. The Utility Theory is implemented to assign utility values to each level of each attribute according to expert opinions. Based on these utility values, the cost index for the composite part is calculated. The fuzzy theory is introduced as a means to handle the uncertainty and fuzziness of these utility values. A genetic algorithm is employed to determine the weights in the model. The major advantage of their cost model is that the method can be used at the design phase of composite structures, even if the information about the composite structure fabrication is incomplete or uncertain.

*IJISE* proposes and fosters discussion on the development of ISE principles, tools, systems, and methods with special emphasis on the applications of ISE techniques and tools in improving the organisational productivity and competitiveness in the global markets. Globalisation of markets and operations are closely related to the success of a company. Therefore, the importance of effective ISE strategies, tools, techniques and practice for organisational effectiveness and competitiveness cannot be underestimated.

The Journal acts as a vehicle to help professionals, academics and researchers, working in the field of ISE, to disseminate information and latest developments and to learn from each other's research. The journal publishes original papers, review papers, technical reports, case studies, book reviews and notes. Special Issues devoted to important topics in ISE will occasionally be published. The following are the topics covered by *IJISE* (but not limited to):

- engineering economic analysis
- computer methods for engineering
- engineering experiment design
- integrated manufacturing systems
- quality engineering
- systems reliability engineering
- human factors and ergonomics in design
- simulation modelling and analysis
- system design and control systems
- production systems analysis and design
- facilities layout and design
- financial and investment engineering
- information systems in ISE
- project management
- information and communication systems
- decision support systems, artificial intelligence and expert systems design
- robotics and automation
- modelling manufacturing systems
- technology management and transfer

- environment risk analysis
- maintenance analysis
- concurrent engineering and system design
- modelling and analysis of engineering systems
- modelling physiological systems
- computer integrated manufacturing systems
- digital systems simulation
- transportation systems.

Academics and practitioners are invited to forward their contributions in ISE areas for possible publication in *IJISE*. The journal also encourages papers on industrial experience or on the implementation of ISE strategies, tools and techniques. Potential editors are welcome for guest editing special issues in emerging areas of ISE. Please direct all your communication to the Editor-in-Chief ([agunasekaran@umassd.edu](mailto:agunasekaran@umassd.edu)).

### **Acknowledgements**

I am most grateful to Dr. Mohammed Dorgham, Mrs. Barbara Curran, Mr. Jim Corlett and Ms. Sue O'Mara of Inderscience Publishers Limited for their excellent professional support throughout the launch of this journal. Moreover, I would like to thank all the distinguished Editorial Board Members who are renowned for their research in the field of ISE for agreeing to serve on the board of *IJISE*. Finally, my sincere thanks go to all the authors who contributed to this inaugural issue for their timely submissions and revisions. Their responsiveness allowed this journal to be launched on time.