International Journal of Simulation Modelling – **Volume 12, Number 3**

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MODELLING AND SIMULATION OF SURFACE ROUGHNESS IN FACE MILLING

Simunovic, G.; Simunovic, K. & Saric, T.
University of Osijek, Mechanical Engineering Faculty in Slavonski Brod, Trg I. Brlic Mazuranic 2, Slavonski Brod, Croatia
E-Mail: goran.simunovic@sfsb.hr

Abstract
The paper presents a research on machined surface roughness in face milling of aluminium alloy on a low power cutting machine. Based on the results of the central-composite plan of experiment with varying machining parameters (number of revolutions - spindle speed *n*, feed rate *f* and depth of cut *a*) and the roughness observed as output variable, two models have been developed: a regression model and a model based on the application of neural networks (NN model). The regression model (coefficient of determination of 0.965 or 0.952 adjusted) with insignificant lack of fit, provides a very good fit and can be used to predict roughness throughout the region of experimentation. Likewise, the model based on the application of neural networks approximates well the experimental results with the level of RMS (Root Mean Square) error in the phase of validation of 4.01 %. 29 refs.
(Received in February 2012, accepted in March 2013. This paper was with the authors 4 months for 2 revisions.)

Key Words: *Face Milling, Central Composite Design, Regression, Neural Networks, Modelling and Simulation*

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OPTIMIZATION OF CALIBRATING HeNe LASER INTERFEROMETERS BY SAMPLE-PERIOD SIMULATION

Lipus, L. C.; Matus, M. & Acko, B.
University of Maribor, Faculty of Mechanical Engineering, Smetanova 17, Maribor, Slovenia
E-Mail: bojan.acko@um.si

Abstract
The calibration procedure for the frequency determination of HeNe laser interferometers used for length metrology is described and high-level traceability at the Metrology Institute of the Republic of Slovenia (MIRS) consistent with the Mutual Recognition Arrangement drawn up by the International Committee for Weights and Measures (CIPM MRA) is presented in the article. The analyses of radiation frequency regarding stabilization time, repeatability and reproducibility are given for a case of an industrial and of a laboratory HeNe laser interferometer. Allan-deviation calculations at different sampling periods provided information for setting the optimal sampling period and proved that 100 000 samples at one-second or 10 000 samples at ten-second long period are usually the most appropriate sets for one-day calibration measurements. 30 refs.
(Received in August 2012, accepted in March 2013. This paper was with the authors 3 months for 2 revisions.)

Key Words: *Iodine Stabilized Laser, Optical Frequency Standard, Metrological Traceability*

Pages 164-177

IMPACT OF ASSIGNMENT, INVENTORY POLICIES AND DEMAND PATTERNS ON SUPPLY CHAIN PERFORMANCE

Al-Hawari, T.; Ahmed, A.; Khrais, S. & Mumani, A.
Industrial Engineering Department, Jordan University of Science and Technology, Irbid, Jordan
E-Mail: tarek321@just.edu.jo

Abstract
A simulation model is built to analyse the performance of a four-level/three-product supply chain composed of a retailer, distributor, manufacturer and supplier. The effects of assignment policies; preferred, cyclical and random, were analysed in combination with various factors such as inventory policies; continuous review (*r, Q*) and periodic review (*T, S*), and different demand patterns. On-hand inventory and percentage of satisfied customers at various levels of the SC are used as key performance indicators. In (*T, S*) systems, it is found that imposing an upper limit on *S* in some SC levels due to the assumption that an order is shipped as a whole in one trip would greatly influence results. Consequently, an increase in *T* not associated with a sufficient increase in *S* would decrease inventory levels that would lead to shortages between orders. In (*r, Q*) systems, the results show clearly how the effect of increasing *Q* in one level is transformed to upstream and downstream levels. Upstream levels are all negatively affected, while downstream levels maintain the same levels of inventory without any noticeable trends. ANOVA results show that at low demand rates inventory policies are the most significant, then demand patterns while the assignment policies are mostly insignificant. At high demand rates the assignment policy factor becomes significant as well as the other two factors. Sensitivity analysis performed shows the robustness of the results under varying conditions. 19 refs.
(Received in August 2012, accepted in March 2013. This paper was with the authors 3 months for 3 revisions.)

Key Words: *Supply Chain Management, Assignment Policies, Inventory Policies, Simulation*

Pages 178-189

SUPPLY CHAIN ANALYSIS USING SIMULATION, GAUSSIAN PROCESS MODELLING AND OPTIMISATION

Smew, W.; Young, P. & Geraghty, J.
Enterprise Process Research Centre, School of Mechanical and Manufacturing Engineering, Dublin City University, Dublin 9, Ireland
E-Mail: walid.smew@dcu.ie, paul.young@dcu.ie, john.geraghty@dcu.ie

Abstract
This paper presents a simulation study on production and inventory control at the supply chain (SC) level and examines through a series of experiments the potential impact of the Hybrid Kanban-CONWIP production control strategy on the trade-off between the conflicting objectives of maximising customer service level and minimising Work-In-Process (WIP). Simulation based optimisation is computationally expensive approach to determining an optimal configuration of operational parameters for any stochastic system. In this paper we demonstrate an optimisation framework that will yield solutions with an accuracy that is reasonable for decision makers and computationally less expensive than simulation based optimisation. A simulation model for a centralised serial SC adopting Hybrid Kanban-CONWIP to process a single product was developed in order to explore the impact of some essential input factors on customer service level and average WIP through Design of Experiments (DOE), Gaussian Process Modelling (GP) and Metamodel-Based Optimisation using the Desirability Function. The precision of the results from this approach was determined by comparison to results from Simulation-Based Optimisation by means of Genetic Algorithms (GA). It has been shown that this framework will address the trade-off between accuracy and computational efficiency requirements of the decision maker. 27 refs.
(Extended paper from the International Conference on Industrial Logistics – ICIL 2012, June 14-16, 2012, Zadar, Croatia. Received in August 2012, accepted in February 2013. This paper was with the authors 3 months for 1 revision.)

Key Words: *Supply Chain Management, Hybrid Kanban-CONWIP, Discrete Event Simulation, Gaussian Process Modelling, Optimisation*

Pages 190-204

MINIMIZATION OF MEAN TARDINESS IN A FLEXIBLE JOB SHOP

Singh, A.
Indian Institute of Management, Rohtak, Haryana, India
E-Mail: amol.singh@iimrohtak.ac.in

Abstract
In this paper, Selective Rerouting (SR) approach based on lateral entry of critical jobs in the queue of alternate machine is used to minimize the mean tardiness of the jobs in flexible job shop. Further, the efficacy of selective rerouting algorithm has been investigated by comparing it to the rerouting policies. Simulation studies using ProModel simulation software were carried out at different breakdown levels, mean time to repair levels, utilization levels of flexible job shop, due date tightness levels involving a total of 600 simulation runs. Each run of simulation spans for a period of 2000 completed jobs. The results establish that the proposed selective rerouting approach is better than other reported rerouting approaches as it improves 69.92 %, 69.31 %, 65.33 %, and 44.27 % mean tardiness compared with no rerouting, queue rerouting, arrival rerouting and all rerouting approaches respectively. It is seen that irrespective of the breakdown level in the investigated range, reduction of mean tardiness decreases in no rerouting, all rerouting, queue rerouting and arrival rerouting in the above order. 24 refs.
(Received in September 2012, accepted in February 2013. This paper was with the author 1 month for 2 revisions.)

Key Words: *Flexible Job Shop, Tardiness, Scheduling, Rerouting and Machine Breakdowns*