Volume 4, Number 2

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DEADLOCK ANALYSIS IN FMS IN THE PRESENCE OF FLEXIBLE PROCESS PLANS – A SIMULATION STUDY

Jain, A.; Jain, P. K. & Singh, I. P.
Mechanical Engineering Department, National Institute of Technology, Kurukshetra, India
E-mail: ajaijain12@indiatimes.com

Abstract
The increased use of FMS to provide customers with diversified products efficiently has created a significant set of operational challenges for managers. This technology presents a number of decision problems to be solved by researchers and practitioners. There have been a number of attempts to solve design and operational problems in FMS. A special attention has been given to batch scheduling when flexible process plans (FPPs) remain available on the shop floor. An extensive simulation study under two manufacturing environments is performed to study the system performance in the presence of FPPs. Several interesting conclusions have been drawn from deadlock, makespan and mean flow time criteria. 31 refs.

Key Words: *FMS Scheduling, Flexible Process Plans, Deadlock Avoidance*

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GEARBOX VIBRATORY ANALYSIS USING CARRYING, COUPLING AND SLAVE SUBSTRUCTURES

Abbes, M. S.; Fakhfakh, T. & Haddar, M.
Mechanics Modelling and Production Research Unit, Mechanical Engineering Department
National School of Engineers of Sfax (ENIS), Sfax, Tunisia
E-mail: m_haddar@voila.fr

Abstract
Vibration analysis of complex structures is usually accomplished by analysing its finite element model. When the total number of degrees of freedom in the model is too large, we deal with large-scale eigenvalue problems. The classical approach for the solution of such problems consists in reducing the number of unknowns, allowing reducing the computational cost of eigensolver. Component mode synthesis or dynamic substructuring methods are appropriate tools for this reduction. In this paper, a novel approach in dynamic substructuring for numerical simulation of complex structures is presented and three type of substructure are considered. (1) Carrying substructure (plates and beams), (2) coupling substructure (organs joining carrying substructures), (3) slave substructure (elements connected to the carrying substructure). This approach is based on the use of the Craig-Bampton decomposition of the admissible displacement field. A numerical example is presented. A gearbox with elastic casing, two transmission shafts and one helical gear pair is analyzed and concepts for reduced noise and vibration are identified. 15 refs.

Key Words: *Substructuring Method, Gearbox Modelling, Numerical Simulation, Eigenvalues*

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VERIFICATION OF THE CONVENTIONAL MEASURING UNCERTAINTY EVALUATION MODEL WITH MONTE CARLO SIMULATION

Acko, B. & Godina, A.
University of Maribor, Faculty of Mechanical Engineering, Maribor, Slovenia
E-mail: bojan.acko@uni-mb.si

Abstract
Calibration of gauge blocks by mechanical comparison is widely used for assuring traceability of industrial measurements for the physical quantity “length”. In order to diminish uncertainty of calibration, we shall control all influence parameters very precisely. We must be able to predict intervals of changes of these parameters in short and long term intervals and include those changes in the uncertainty budget. Mathematical model of measurement is used for calculating standard uncertainty of the output value (calibration result) from the uncertainties of the input (influence) quantities. However, this calculation is reliable only if the uncertainties of the influence quantities are evaluated accurately. Therefore, we decided to verify the uncertainty calculations from the past by Monte Carlo simulation, which are also proposed by the new draft of the Guide to the Expression Uncertainty in Measurement (GUM). The approach and the results of this verification are presented in the article. 15 refs.

Key Words: *Measuring Uncertainty Model, Calibration, Gauge Blocks, Monte Carlo Simulation*

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SIMULATION OF SOFT ROBUST NONLINEAR CONTROL OF A PMSM

Viehweider, A. & Wittmann, B.
Institute of Automation and Control, Vienna University of Technology, Vienna, Austria
E-mail: viehweider@acin.tuwien.ac.at

Abstract
A backstepping controller for a permanent magnet synchronous motor (PMSM) with a nonlinear load is devised. In order to improve the control law dynamics a technique introduced by Freeman and Kokotovic is adapted for the special application. The PMSM has been modelled with special consideration of the cross coupling effect. As compared to the conventional speed control approach higher precision in following a speed reference signal is achieved. The effect of high control law dynamics can be attenuated by proper forming of the Lyapunov function. By the use of simulation the effectiveness of the approach is demonstrated. 13 refs.

Key Words: *Robust Backstepping, Nonlinear Control, Permanent Magnet Synchronous Motor, Cross Coupling Modelling, Soft Control Law*