Manufacturing Technology Abstracts

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MANUFACTURING TECHNOLOGY ABSTRACTS

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MANUFACTURING TECHNOLOGY ABSTRACTS

MANUFACTURING SYSTEMS

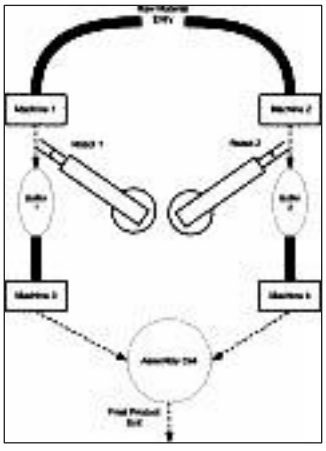
110427 Stochasic cell loading to minimize nT subject to maximum acceptable probability of tardiness [1]

Gökhan Eğilmez, Gürsel A. Süer *[J of Manufacturing Systems, v 35, Apr 2015, Staring Page 136, Pages 8]* In this paper, stochasic cell loading problem is addressed. The problem is observed in labor-intensive manufacturing cells where operaion imes and hence in-cell imes are probabilisic due to coninuous operator involvement throughout the manufacturing processes. The objecive is to minimize the number of tardy jobs subject to maximum acceptable probability of tardiness (risk level). A job is called "tardy" if the probability of tardiness is greater than the risk level otherwise it is called early. The risk level is used as a preferred scheduling risk that will be taken by operaions planner. A stochasic non-linear mathemaical model is developed. Normally distributed processing imes and determinisic due dates are used in the experimentaion. Various experiments are carried out to study the impacts of risk level, problem size and operaion ime variance on the opimal schedule. Proposed stochasic approach lets scheduler to sequence the jobs subject to an acceptable risk level. As the risk level increased, the number of jobs included in the schedule increased as well. Similarly, as the risk level increased, the probability of tardiness also increased especially for the jobs that are scheduled in the later posiions. Unlike the determinisic model, the results of proposed approach are sensiive to the change in operaion ime variance. It is recommended to work with the safest schedule (0% risk), when the operaion ime variance is signiicantly high. (60 refs 2 igs 5 tables) (AA)

110428 Synthesis and PLC implementaion of hybrid modular supervisors for real ime control of an experimental manufacturing system [2]

Gelen, Gökhan; Uzam, Murat *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 535, Pages 16]* In this paper, synthesis and PLC based implementaion of hybrid modular supervisors for real ime supervisory control of an experimental manufacturing system are proposed. The hybrid approach couples Ramadge–Wonham (RW) supervisors in the form of automata to uncontrolled PN models through inhibitor arcs. The RW supervisors can be obtained in monolithic or modular forms. In the monolithic case, there is only a single supervisor that has complex structure and huge number of states and events. The modularity of supervisors provides simple and small control structures compared to monolithic ones. Modular hybrid approach ofers fewer states for the PLC implementaion of the hybrid controller with less memory requirements. The applicability and efeciveness of the modular hybrid approach are demonstrated by the PLC based real-ime control of an experimental manufacturing system for diferent cases. The obtained results show that modular supervisors require less memory space compared to monolithic counterparts. (31 refs, 18 igs, 3 tables) (AA)

110429 Idenifying FMS repeiive paterns for eicient search-based scheduling algorithm: A colored Petri net approach [3]



Olatunde T. Baruwa, Miquel A. Piera *[J of Manufacturing Systems, v 35, Apr 2015, Staring Page 120, Pages 16]* The muliple lot size scheduling problem plays a crucial role in minimizing producion and setup costs in order to respond to constant luctuaions in customer demands. However, the computaional cost to opimize a scheduling problem increases as the lot size of jobs increases, leading to a scalability problem for most scheduling algorithms. This paper presents an eicient search approach based on colored Petri net (CPN) formalism that addresses the state explosion problem of reachability graphs used for inding the opimal soluions to scheduling problems. To reduce the memory requirements, the proposed approach exploits the structural equivalence found in the reachability graphs of lexible manufacturing systems' (FMS) CPNs to discard states once they are no longer needed to explore the state space. The hypotheical structural equivalence is atributed to the repeiive paterns ideniied in the execuion of manufacturing processes when the lot sizes of jobs are scaled for FMS whose

underlying layout coniguraion is ixed. We present the concept of structural equivalence based on duplicate state detecion for FMS of diferent lot sizes and give suicient condiions under which the structural equivalence obtained from a few lot size (smaller) instances holds for the same FMS of a larger size. The approach is validated experimentally on diferent FMS examples which conirm that the behavior of an FMS of any large lot size can be inferred from the FMS of a smaller size. Experimental results indicate that this work performs beter than prior search methods and obtains opimal schedules of FMS with large lot sizes. Also, we show that the approach is applicable to FMS problems of similar coniguraions where the problem size difer by the number of jobs, resources and operaions. (70 refs 2 igs 5 tables) (AA)

110430 Esimaing arrival imes of transportaion jobs for automated material handling in LCD fabricaion facilities [4]

Jaewoo Chung *[J of Manufacturing Systems, v 35, Apr 2015, Staring Page 112, Pages 8]*

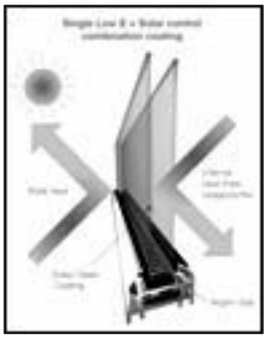
A modern LCD fabricaion facility uses state-of-art automaion technology to enhance manufacturing compeiiveness driven by shorter cycle imes, faster deliveries, and higher quality products. All transportaion jobs from a process toolset to other toolsets during fabricaion are done by automated material handling systems such as industrial robots, automated cranes, and AGVs (automated guided vehicles) in the industry. Esimaing transportaion imes are important since the informaion can be used to improve the performance of the material handling systems by providing the expected arrival ime of a job compared to its arrival due ime, which can be used to change the priority of the transportaion more dynamically. This paper develops a new heurisic method based on a stochasic approach to esimate the arrival imes of transportaion jobs to their inal desinaions in an LCD fabricaion facility. To analyze the performance of the new method, the author collected a set of actual transportaion data from the industry and the analysis shows that the new method outperforms an exising method that uses simple staisics based on historical data. (20 refs 8 igs 2 tables) (AA)

110431 Opimizing a closed-loop supply chain with manufacturing defects and quality dependent return rate [5]

B.C. Giri, S. Sharma *[J of Manufacturing Systems, v 35, Apr 2015, Staring Page 92, Pages 20]*

The paper considers a closed-loop serial supply chain consising of a raw material supplier, a manufacturer, a retailer and a collector who collects the used product from consumers. The retailer's demand is met up by both manufacturing and remanufacturing. The manufacturing process is assumed to be imperfect as it can produce some defecives which are reworked in the same cycle itself. The remanufacturing of used items solely depends on the quality level of collected items. Two mathemaical models are developed. The irst model considers a single manufacturing–remanufacturing cycle, while the second model considers muliple manufacturing and remanufacturing cycles. Both the models are solved using algorithms developed for sequenial and global opimizaions. Numerical studies show that (i) the acceptance quality level of returned items and the length of the replenishment cycle for the retailer are lower in case of sequenial opimizaion than those in global opimizaion, (ii) integraion among supply chain members results in less number of shipments from the manufacturer to the retailer, and (iii) the joint total proit is higher when the integrated approach is adopted. The percentage increase in joint total proit with the integrated policy is 1.24% in the irst model while it is 0.544% in the second model. (20 refs 5 igs 14 tables) (AA)

110432 Robust Phase I monitoring of proile data with applicaion in low-E glass manufacturing processes [6]

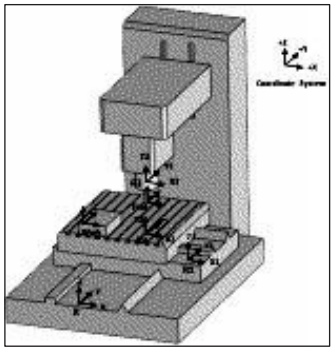


Zeng, Li; Neogi, Smrii; Zhou, Qiang *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 508, Pages 14]*

Normality is usually assumed in proile monitor-ing. However, there are many cases in pracice where normality does not hold. In such cases, convenional monitoring techniques may not perform well. In this study, we propose a robust strategy for Phase I monitoring of quality proile data in the presence of non-normality. This strategy consists of three components: modeling of proiles, independent component analysis (ICA) to transform mulivariate coeicient esimates in proile modeling to independent univariate data, and univariate nonparametric control charts to detect locaion/scale shits in the data. Two methods for muliple change point detecion are also studied. The properies of the proposed

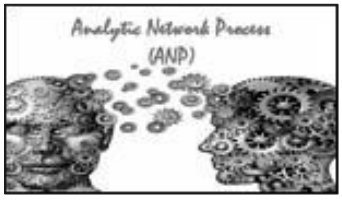
method are examined in a numerical study and it is applied to opical proiles from low-E glass manufacturing in the case study. (36 refs, 15 igs, 5 tables) (AA)

110433 Virtual machining considering dimensional, geometrical and tool delecion errors in three-axis CNC milling machines [7]



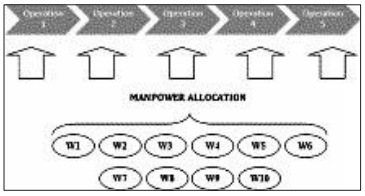
Soori, Mohsen; Arezoo, Behrooz; Habibi, Mohsen *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 498, Pages 10]* Virtual manufacturing systems can provide useful means for products to be manufactured without the need of physical tesing on the shop loor. As a result, the ime and cost of part producion can be decreased. There are diferent error sources in machine tools such as tool delecion, geometrical deviaions of moving axis and thermal distorions of machine tool structures. Some of these errors can be decreased by controlling the machining process and environmental parameters. However other errors like tool delecion and geometrical errors which have a big porion of the total error, need more atenion. This paper presents a virtual machining system in order to enforce dimensional, geometrical and tool delecion errors in three-axis milling operaions. The system receives 21 dimensional and geometrical errors of a machine tool and machining codes of a speciic part as input. The output of the system is the modiied codes which will produce actual machined part in the virtual environment. (28 refs, 20 igs) (AA)

110434 Applicaion of the Analyic Network Process to facility layout selection [8]



Al-Hawari, Tarek; Mumani, Ahmad; Momani, Amer *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 488, Pages 10]* This paper applies the Analyic Network Process (ANP) method to the selecion of the best facility layout plan based on muliple dependent and independent criteria. This is the irst ime that this method is used in such a context. An ANP model is built taking into account the interdependencies between criteria that are found based on experts' opinions and fundamental equaions. A network structure is built that shows all elements and clusters and their interacions that can be used to ind the most efecive layout. Limit prioriies are computed which idenify the most important factors in the selecion process. A case study is conducted in a wood factory which represents a real demonstraion of the developed model. A comparison is conducted between ANP and Analyic Hierarchy Process (AHP) which shows the diferences between the two methods. Finally, sensiivity analysis shows the robustness of the model. (34 refs, 5 igs, 8 tables) (AA)

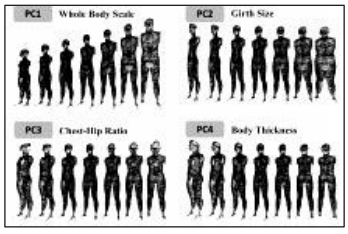
110435 Stochasic skill-based manpower allocaion in a cellular manufacturing system [9]



Egilmez, Gokhan; Erenay, Bulent; Süer, Gürsel A *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 578, Pages 11]* In this paper, stochasic skill-based manpower allocaion problem is addressed, where operaion imes and customer demand are uncertain. A four-phased hierarchical methodology is developed. Egilmez and Süer's [1] stochasic general manpower allocaion problem is extended such that each worker's individual performance is considered for a more accurate manpower allocaion to manufacturing cells to maximize the producion rate. The proposed methodology opimized the manpower levels, product-cell formaions and individual worker assignment hierarchically with respect to a speciied risk level. Three stochasic nonlinear mathemaical models were developed to deal with manpower level determinaion, cell loading and individual worker assignment phases. In all models, processing imes and demand were assumed to be normally distributed. Firstly, alternaive coniguraions were generated. Secondly, IID sampling and staisical analysis were uilized to convert probabilisic demand into probabilisic capacity requirements. Thirdly, stochasic manpower allocaion was performed and products were loaded to cells. In the inal phase, individual worker assignments were performed. The proposed methodology was illustrated with an example problem drawn from a real manufacturing company. The hierarchical approach allows decision makers to perform manpower level determinaion, cell loading and individual worker assignment with respect to the desired risk level. The main contribuion of this

approach is that each worker's expected and standard deviaion of processing ime on each operaion is considered individually to opimize the manpower assignment to cells and maximize the manufacturing system producion rate within a hierarchical robust opimizaion approach. (43 refs, 3 igs, 10 tables) (AA)

110436 Ergonomic job rotaion strategy based on an automated RGB-D anthropometric measuring system [10]

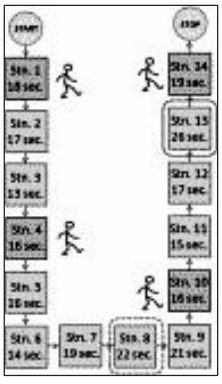


Huang, Szu-Hao; Pan, Ying-Cheng *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 699, Pages 12]* Ergonomic job rotaion is a novel strategy to increase work eiciency and decrease work faigue of the operators in manufacturing lines. In this paper, we proposed an automated anthropometric measuring system based on RGB-D camera and a job rotaion strategy based on paricle swarm opimizaion (PSO). The irst training stage involved a series of 3D data-processing techniques to generate parametric models from scanning human database. The second stage can esimate the anthropometric measurements from the depth maps captured by RGB-D camera system. Finally, a novel job rotaion strategy is proposed with PSO based on three target funcions, which are designed to measure the work discomfort levels and risks. The experimental data is a real case which includes the operators of a quartz blanks manufacturing line. The experimental results show that our proposed system can efecively and dramaically reduce the average risk and decrease the number of operators who experienced either a high risk or a medium risk levels. (38 refs, 6 igs, 9 tables) (AA)

110437 Cost performance dynamics in lean producion leveling [11]

Deif, Ahmed M; ElMaraghy, Hoda *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Starting Page 613, Pages 11]* Balancing of producion systems is one of the mainleanmanufacturing principles as it reduces in-process storage and related forms of waste. A dynamic systems approach is proposed to invesigate challenges of implemening producion leveling and associated costs. A lean cell producing at takt ime is modeled using system dynamics. The model captures various lean tools inluencing producion leveling and their implicaions. Comparaive cost analysis between various leveling implementaion policies for stochasic demand with muliple products is conducted. Results showed that determining the most feasible leveling policy is highly dictated by both the cost and limitaions of capacity scalability. In addiion, delivery sequence plans of diferent products/parts needed to achieve mix leveling and lot sizes afect the feasible producion leveling policy while implemening lean principles. The developed model and insights gained from the results can help lean manufacturing praciioners to beter decide when and how to implement producion leveling as well as determine both producion lots sizes and sequence. They also emphasize the importance of cost analysis as assising decision support tool in the trade-of required between the beneits of diferent levels of lean policies and their associated cost. (34 refs, 8 igs, 2 tables) (AA)

110438 On the complexity of using performance measures: Enhancing sustained producion improvement capability by combining OEE and productivity [12]



Andersson, C; Bellgran, M: *[J of Manufacturing Systems, v 35, Apr 2015, Staring Page 144, Pages 11]* The global speed of change within the manufacturing industry forces companies to constantly improve product-ion performance. In that efort, performance measures are criical for driving and managing producion improvements. Two of the most commonly used measures in operaions are producivity and overall equipment eiciency (OEE). However, the potenial of using these measures as improvement drivers is not fully uilized in industry today due, for example, to ambiguiies in deiniions and their interpretaion. A study of available theory indicates a gap between these implicaions from a theoreical perspecive vs. the industrial perspecive. Bridging this theory–pracice gap implies great potenial for compeiiveness and growth in manufacturing, since the latent producion capacity that could be uilized is tremendous. Even if a high degree of complexity in

deiniion and calculaion when applied in operaional condiions might be perceived, this paper will show that a systemaically used combined set of OEE and producivity measures can successfully drive producion improvements. Also, two new producivity measures for driving improvements at the shop loor level are proposed. The empirical indings are based on a two-year case study within a manufacturing company in the automoive industry using an interacive research approach. (40 refs 6 igs 1 table) (AA)

MATERIALS & TREATMENT

110439 Oxidaion behavior of gas-atomized Al and Al alloy powder green compacts during heaing before hot extrusion and the suggested heaing process [13]

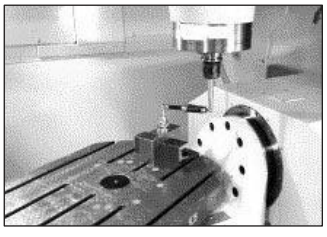
Krizik, Peter; Balog, Marin; Illekova, Emilia; Svec Sr., Peter; Matko, Igor; Stepanek, Matej; Nosko, Marin; Simancik, Franisek *[J of Materials Processing Technology, v 214, n 6, Jun 2014, Staring Page 1165, Pages 8]* The oxidaion behavior of gas-atomized Al and Al alloy powder green compacts during heaing prior to hot extrusion compacion was studied at laboratory and industrial scales by TGA, DSC, DTA, EDX, TEM and XRD methods. The efect of the heaing of green compacts on the mechanical properies of the powder-extruded samples was assessed. Signiicant oxidaion of Al and Al alloy powder green compacts takes place in the solid state during heaing in air. T An exothermic heat associated with the oxidaion of Al and Al alloy powders resulted in intense overheaing of bulky powder green compacts during heaing in air. The samples extruded from the powder green compacts heated in air exhibited reduced strength. The loss in strength was especially pronounced in the case of Mg-containing Al alloy powders. Mg difuses from a powder metallic core toward the naive Al2O3 surface layer present on as-atomized Al alloy powders; it reacts with oxygen present in air and in the Al2O3 surface layer where the MgO phase forms, eventually resuling in the depleion of Mg from the powder core. Materials extruded from Al powders depleted of Mg do not exhibit efecive Al-Mg solid soluion strengthening or strengthening by Mg-containing precipitates. Economically viable approaches to avoiding the detrimental efects of powder oxidaion during the heaing of green compactsprior to hot working consolidaion are discussed. (18 refs 8 igs 5 tables) (AA)

MEASUREMENT & TESTING

110440 Evaluaion of the inluence of a planned interference it on the expected faigue life of a conjugate cam mechanism- a case study [14]

Català, Pau; Santos, Maria Antònia De los; Veciana, Joaquim M; Cardona, Salvador *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081002, Pages 8]* Due to dynamic efects, clearances, manufacturing and assembly errors in form-closed cam mechanisms, the follower jump can also occur. For conjugate cam mechanisms a technique to avoid the follower jump without the use of a spring involves making the conjugate cam proiles bigger than the kinemaical ones by adding an external ofset. This strategy produces an interference it between the conjugate cam proiles and the follower train. This paper presents an ordered procedure to study the inluence that the planned interference it has on the evaluaion of the contact forces, the expected faigue life of the rollers, contact pressures and the lubricaion condiions. The study is based on a conjugate cam mechanism with translaional roller followers used in a real automaic process for manufacturing muselets. A three-degree-of-freedom dynamic model is proposed and the Hertzian theory for general proiles is used to model the nonlinear contact sifness between the cams and the crowned rollers. The dynamic model predicts that it is diicult to obtain conjugate cam mechanisms with an ininite expected faigue life of the rollers just by considering typical achievable manufacturing errors or clearances, and as happens in reality, a set-up process is highly recommended. The procedure is also tested with measured manufacturing errors on a coordinate measure machine—CMM—and with measured radial internal clearances for the rollers measured by an experimental apparatus. Also, to evaluate lubricaion condiions, surface inishing measurements have been taken of the cams and the rollers with a surface proiler. (21 refs 17 igs 4 tables) (AA)

110441 Ballbar dynamic tests for rotary axes of ive-axis CNC machine tools [15]

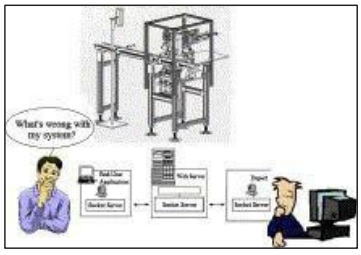


Lei, Wei-Tai; Wang, Wen-Chung; Fang, Tien-Ching *[Int J of Machine Tools & Manufacture, v 82-83, Jul-Aug 2014, Staring Page 29, Pages 13]* This paper proposes a

new ball bar test method for the inspecion of dynamic errors of rotary axes in ive-axis CNC machine tools. The test circle is deined in a workpiece coordinate system and the ball bar test is performed by simultaneously driving of linear–rotary axis couple. The efects of the center posiion and the radius on the seing values, rotaional range and measurement sensiivity of the rotary axis were invesigated. The proposed ball bar test is performed in two steps: the circular posiioning and the circular tracking with a coninuous feed. Axial dynamic errors are obtained by subtracing the measured tracking errors from the posiioning errors. A ball bar test system (BBTS) was developed to plan the tool path and the tool orientaion, to communicate with the ive-axis CNC controller and to process the measured data. Error paterns were simulated regarding the gain mismatch, backlash and tracking direcion to help a fast diagnosis of the error sources. Simulaions and experimental results prove the efeciveness of the new test method. (16 refs 20 igs 2 tables) (AA)

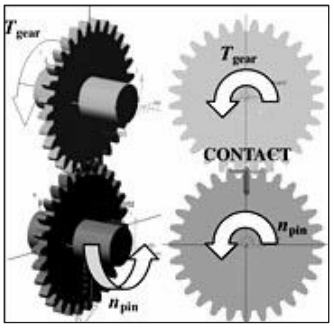
PRODUCT DESIGN & MANUFACTURE

110442 Study of factors impacing remote diagnosis performance on a PLC based automated system [16]



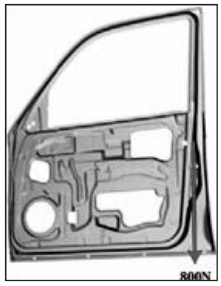
Wu, Zhenhua; Sekar, Ramnath; Hsieh, Sheng-jen ("Tony") *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 589, Pages 15]* In this paper, we present systemaically experimental and analyical evaluaions on design of remote fault diagnosis systems for a programmable logic controller (PLC) based automated system. In order to invesigate the factors of remote architecture, operator's skill level, and fault's efect on diagnosis performance, comprehensive experimental evaluaions, staisical analysis and survey were conducted. The experiment compared three levels of remote architectures, two levels of operators' skill levels on four typical faults in an automated system. Performance evaluaion including detecion ime, amount of informaion search, number of diagnosic tests, number of asked quesions, number of system runs, and performance score, were extracted from the experiment record. Two-stage staisical analysis including (1) analysis of variance (ANOVA) and (2) least signiicant diference (LSD) paired comparison wasconducted on the performance evaluaion data. From the staisical analysis results and expert survey, we concluded that: (1) the architecture sophisicaion eased the diagnosis on the faults that are related to the measurement signals, and (2) the diagnosis performance also increased with the sophisicaion of the architecture, but (3) operator's skill level did not signiicantly afect the diagnosis performance. The survey results on troubleshooters' opinions and preferences about the diagnosis were also summarized, which can be applied for improvement on design of remote diagnosis system. The proposed evaluaion approach is systemaic; it can be applied on design and evaluaion of diagnosics systems on other PLC based automated systems such as heaing, venilaion, and air condiioning (HVAC), roboics assembly. (27 refs, 7 igs, 17 tables) (AA)

110443 Uncertainty Consideraions in the Dynamic Loading and Failure of Spur Gear Pairs [17]



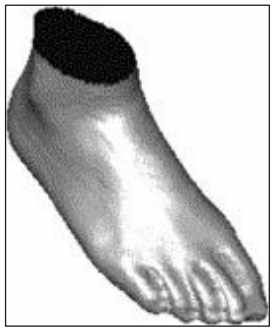
Alemayehu, Fisseha M; Ekwaro-Osire, Stephen *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 084501, Pages 7]* Gears and gear systems, like any other mechanical system, are subjected to design parameter, and loading uncertainies emanaing from inherent randomness, manufacturing, and assembly errors. The tradiional determinisic approach to the design of such systems overlooks these uncertainies. This work presents a novel probabilisic mulibody dynamic analysis (PMBDA) that enhances the determinisic design pracice of gears and gear systems. A contact based, rigid mulibody spur gear pair model with random loading, and design parameters has been developed. An advanced mean based on fast probability integraion method was implemented to perform a reliability analysis of performance measurements: dynamic factor, root bending stress, and faigue life of gears. Probabilisic sensiivity analysis of these performance funcions to several random variables was also determined. In addiion to revealing system reliability or probability of failure, the PMBDA approach also helps designers to consider certain variables criically. (19 refs 10 igs 3 tables) (AA)

110444 Parallel reanalysis method based on approximate inverse matrix for complex engineering problems [18]



Wang, Hu; Li, Enying; Li, Guangyao *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081001, Pages 8]* The combined approximaions (CA) method is an efecive reanalysis approach providing high quality results. The CA method is suitable for a wide range of structural opimizaion problems including linear reanalysis, nonlinear reanalysis and eigenvalue reanalysis. However, with increasing complexity and scale of engineering problems, the eiciency of the CA method might not be guaranteed. A major botleneck of the CA is how to obtain reduced basis vectors eiciently. Therefore, a modiied CA method, based on approximaion of the inverse matrix, is suggested. Based on the symmetric successive over-relaxaion (SSOR) and compressed sparse row (CSR), the eiciency of CA method is shown to be much improved and corresponding storage space markedly reduced. In order to further improve the eiciency, the suggested strategy is implemented on a graphic processing unit (GPU) plaform. To verify the performance of the suggested method, several case studies are undertaken. Compared with the popular serial CA method, the results demonstrate that the suggested GPU-based CA method is an order of magnitude faster for the same level of accuracy. (33 refs 15 igs 4 tables) (AA)

110445 Virtual try-on system in augmented reality using RGB-D cameras for footwear personalizaion [19]



Yang, Yu-I; Yang, Chih-Kai; Chu, Chih-Hsing *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 690, Pages 9]* This paper presents a system for design evaluaion of footwear using commercial depth-sensing technologies. In a mixed reality environment, the system allows users to virtually try on 3D shoe models in a live video stream. A two-stage object tracking algorithm was developed to correctly align shoe models to moving feet during the try-on process. Color markers on the user's foot enabled markerless tracking. Tracking was driven by an iteraive closest point (ICP) algorithm that superimposed the captured depth data and predeined reference foot models. Test data showed that the two-stage approach resulted in increased posiional accuracy compared with tracking using only surface registraion. Trimming the reference model using the instant view angle increased the computaional eiciency of the ICP algorithm. The proposed virtual try-on funcion is an efecive tool for realizing human-centered design. This study also demonstrated a new applicaion of RGB-D cameras to product design. (29 refs, 14 igs, 1 table) (AA)

110446 Evoluionary algorithm based approach to design opimizaion using evidence theory [20]

Srivastava, Rupesh Kumar; Deb, Kalyanmoy; Tulshyan, Rupesh *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081003, Pages 12]* For problems involving uncertainies in design variables and parameters, a bi-objecive evoluionary algorithm (EA) based approach to design opimizaion using evidence theory is proposed and implemented in this paper. In addiion to a funcional objecive, a plausibility measure of failure of constraint saisfacion is minimized. Despite some interests in classical opimizaion literature, thisistheirstatempttouse evidence theory with an EA. Due to EA's lexibility in modifying its operators, nonrequirement of any gradient, its ability to handle muliple conlicing objecives, and ease of parallelizaion, evidence-based design opimizaion using an EA is promising. Results on a test problem and two engineering design problems show that the modiied evoluionary muli-objecive opimizaion algorithm is capable of inding a widely distributed trade-of fronier showing diferent opimal soluions corresponding to diferent levels of plausibility failure limits. Furthermore, a single-objecive evidence-based EA is found to produce beter opimal soluions than a previously reported classical opimizaion algorithm. Furthermore, the use of a graphical processing unit (GPU) based parallel compuing plaform demonstrates EA's performance enhancement around 160–700 imes in implemening plausibility computaions. Handling uncertainies of diferent types are geing increasingly popular in applied opimizaion studies and this EA based study is promising to be applied in real-world design opimizaion problems. (43 refs 8 igs 16 tables) (AA)

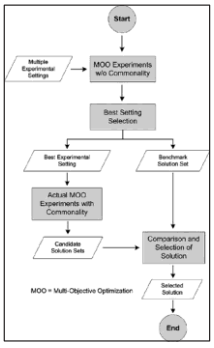
110447 Assembling Creaive Teams in New Product Development Using Creaive Team Familiarity [21]

Sosa, Manuel E; Marle, Franck *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081009, Pages 13]* Creaivity is strongly inluenced by the way individuals are organized. One of the most diicult and important challenges when managing innovaion is to idenify the individuals within an organizaion who must work closely with each other to maximize the generaion of creaive ideas. This paper aims to inform managers of new product development (NPD) organizaions about forming creaive teams. To do so, we extend the noion of team familiarity (i.e., the extent to which team members have worked together before becoming members of a team) by considering the quality of past interacions. We deine creaive team familiarity as the degree to which team members have triggered the generaion of creaive ideas in one another during task-related interacions prior to joining the team. This paper argues that a high level of creaive team familiarity (rather than simply a high level of team familiarity) is posiively associated with a team's capability to produce innovaive outcomes. We test this hypothesis in a unique empirical seing involving paricipants in an internaional execuive MBA program. We also illustrate the implicaions of our indings by idenifying members in a real NPD organizaion who would form a creaive task force with maximum level of creaive team familiarity. (58 refs 6 igs 3 tables) (AA)

110448 Opimal Magnetorheological Damper Coniguraion Using the Taguchi Experimental Design Method [22]

Parlak, Zekeriya; Engin, Tahsin; Şahin, İsmail *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081008, Pages 9]* Magnetorheological (MR) dampers have atracted the interest of suspension designers and researchers because of their variable damping feature, mechanical simplicity, robustness, low power consumpion and fast response. This study deals with the opimal coniguraion of an MR damper using the Taguchi experimental design approach. The opimal soluions of the MR damper are evaluated for the maximum dynamic range and the maximum damper force separately. The MR dampers are constrained in a cylindrical container deined by radius and height. The opimal damper coniguraions obtained from this study are fabricated and tested for veriicaion. The veriicaion tests show that the dampers provide the speciied damper force and dynamic range. (22 refs 9 igs 16 tables) (AA)

110449 Product Family Design Through Ontology-Based Faceted Component Analysis, Selecion, and Opimizaion [23]



Liu, Ying; Lim, Soon Chong Johnson; Lee, Wing Bun *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081007, Pages 17]* Product family design (PFD) is a widely adopted strategy for product realizaion, especially when design requirements are diversiied and muli-faceted. Due to ever-changing customer needs and the increasingly complex and integrated product design structure, PFD and its opimizaion have been concerned more about a rapid and contextual product analysis and variant derivaion based on a muli-objecive opimizaion scheme subject to design concerns, which are oten cross disciplinary, such as product service, carbon footprint, user experience, estheics, etc. Exising PFD modeling approaches, which are primarily structured using component atributes and assembly relaionships, possess notable limitaions in represening complex component and design relaionships. Hence, it has restricted comprehensive PFD analysis in an agile and contextual manner. Previously, we have studied and demonstrated the feasibility of using ontology for product family modeling and have suggested a framework of faceted informaion search and retrieval for product family design. In this paper, several new perspecives towards PFD based on ontology modeling are presented. Firstly, new metrics of ontology-based commonality that beter reveal conceptual similarity under various design perspecives are formed. Secondly, faceted concept ranking is proposed as a new ranking approach for ontology-based component search under complex and heterogeneous design requirements. Thirdly, using these ranked results, a plaform selecion approach that considers a maximum aggregated ranking with a minimal plaform modiicaion among various plaform choices is researched. From the selected plaform and the newly proposed metrics, a modiied muli-objecive evoluionary algorithm with an embedded feature of coniguraion incompaibility check is studied and deployed for the opimal selecion of components. A case study of PFD using four laptop computer families is reported as our irst atempt to showcase how faceted component analysis, selecion, and opimizaion can be accomplished based on the proposed family ontology. (40 refs 9 igs 14 tables) (AA)

110450 Improvement in Ballistae Design From Euitonon to Palintonon: A Study on the Mechanical Advantages [24]
Rossi, C; Pagano, S *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081006, Pages 7]* This study invesigated why the design of ancient throwing machines evolved from euitonon (arms outside the mainframe) to palintonon (arms inside the mainframe) from the end of the irst century B.C. to the irst century A.D. and evaluated the mechanical advantages of the new design. Palintonon was irst used for big machines; in the following centuries, it was also used for much smaller machines. Essenially, the palintonon design has several advantages: more elasic energy can be stored in the hair bundles represening the motors of these machines, heavier projeciles can be thrown with the same charging efort, projeciles are stressed by lower acceleraion in the machine with the same muzzle velocity, and the throwing machines have higher eiciency. Results are also presented regarding the "internal ballisics" of these ancient throwing machines by using simulaion sotware. (27 refs 12 igs) (AA)

110451 Robust Design Opimizaion Under Mixed Uncertainies With Stochasic Expansions [25]
Zhang, Yi; Hosder, Serhat *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081005, Pages 11]* The objecive of this paper is to introduce a computaionally eicient and accurate approach for robust opimizaion under mixed (aleatory and epistemic) uncertainies using stochasic expansions that are based on nonintrusive polynomial chaos (NIPC) method. This approach uilizes stochasic response surfaces obtained with NIPC methods to approximate the objecive funcion and the constraints in the opimizaion formulaion. The opimizaion approach is demonstrated on two model problems with mixed uncertainies: (1) the robust design opimizaion of a slider-crank mechanism and (2) robust design opimizaion of a beam. The stochasic expansions are created with two diferent NIPC methods, Point-Collocaion and Quadrature-Based NIPC. The opimizaion results are compared to the results of another robust opimizaion technique that uilizes double-loop Monte Carlo sampling (MCS) for the propagaion of mixed uncertainies. (21 refs 12 igs 12 tables) (GM)

110452 maximizing design conidence in sequenial simulaion-based opimizaion [26]
Jing Li, Mourelatos, Zissimos P; Kokkolaras, Michael; Papalambros, Panos Y; Gorsich, David J *[J of Mechanical Design, v 135, n 8, Aug 2013, Staring Page 081004, Pages 8]* Computaional simulaion models support a rapid design process. Given model approximaion and operaing condiions uncertainty, designers must have conidence that the designs obtained using simulaions will perform as expected. The tradiional approach to address this need consists of model validaion eforts conducted predominantly prior to the opimizaion process. We argue that model validaion is too dauning of a task to be conducted with meaningful success for design opimizaion problems associated with high-dimensional space and parameter spaces. In contrast, we propose a methodology for maximizing conidence in designs generated during the simulaion-based opimizaion process. Speciically, we adopt a trust-region-like sequenial opimizaion process and uilize a Bayesian hypothesis tesing technique to quanify model conidence, which we maximize by calibraing the simulaion model within local domains if and when necessary. This ensures that the design iterates generated during the sequenial opimizaion process are associated with maximized conidence in the uilized simulaion model. The proposed methodology is illustrated using a canilever beam design subject to vibraion. (30 refs 8 igs 3 tables) (AA)

ARTIFICIAL INTELLIGENCE & ROBOTICS

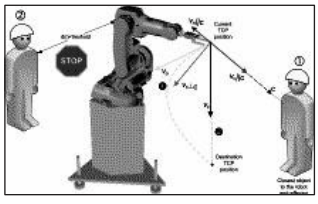
110453 Design and manufacturing of mobile micro manipulaion system with a compliant piezoelectric actuator based micro gripper [27]
Ravi K. Jain, Somajoyi Majumder, Bhaskar Ghosh, Surajit Saha *[J of Manufacturing Systems, v 35, Apr 2015, Staring Page 76, Pages 16]* This paper presents a new design of mobile micro manipulaion system for roboic micro assembly where a compliant piezoelectric actuator based micro gripper is designed for handling the miniature parts and compensaion of misalignment during peg-in-hole assembly is done because piezoelectric actuator has capability of producing the displacement in micron range and generates high force instantaneously. This adjusts the misalignment of peg during roboic micro assembly. The throughput/speed of mobile micro manipulaion system is found for picking and placing the peg from one hole to next hole posiion. An analysis of piezoelectric actuator based micro gripper has been carried out where voltage is controlled through a proporional-derivaive (PD) controller. By developing a prototype, it is demonstrated that compliant piezoelectric actuator based micro gripper is capable of handling

the peg-in-hole assembly task in a mobile micro manipulaion system. (46 refs 30igs 4 tables) (AA)

110454 Flexible ANN-GA-mulivariate algorithm for assessment and opimizaion of machinery producivity in complex producion units [28]

A. Azadeh, H. Shams Mianaei, S.M. Asadzadeh, M. Saberi, M. Sheikhalishahi *[J of Manufacturing Systems, v 35, Apr 2015, Staring Page 46, Pages 30]* This paper presents a lexible algorithm based on ariicial neural networks (ANNs), geneic algorithms (GAs), and mulivariate analysis for performance assessment and opimizaion of complex producion units (CPUs) with respect to machinery producivity indicators (MPIs). Mulivariate techniques include data envelopment analysis (DEA), principal component analysis (PCA) and numerical taxonomy (NT). Two case studies are considered to show the applicability of the proposed approach. In the irst case, the machinery producivity indicators are categorized into four standard classes as availability, machinery stoppage, random failure and value added and producion value. In the second case, the producivity of producion units in terms of health, safety, environment and ergonomics indicators is evaluated. The lexible algorithm is capable of handling both linearity and complexity of data sets. Moreover, ANN and GA are eiciently applied to cover nonlinearity and complexity of CPUs. The results are also validated and veriied by the internal mechanism of the algorithm. The algorithm is applied to a large set of producion units to show its superiority and applicability over convenional approaches. Results show that, in the case of having non-linear data sets, ANN outperforms GA and convenional approaches. The lexible algorithm of this study may be easily extended to other units for assessment and opimizaion of CPUs with respect to machinery indicators. (64 refs 7 igs 23 tables) (AA)

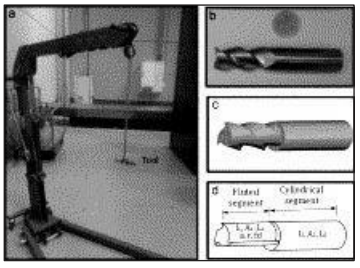
110455 Depth camera based collision avoidance via acive robot control [29]



Schmidt, Bernard; Wang, Lihui *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 711, Pages 8]* A new type of depth cameras can improve the efeciveness of safety monitoring in human–robot collaboraive environment. Especially on today's manufacturing shop loors, safe human–robot collaboraion is of paramount importance for enhanced work eiciency, lexibility, and overall producivity. Within this context, this paper presents a depth camera based approach for cost-efecive real-ime safety monitoring of a human–robot collaboraive assembly cell. The approach is further demonstrated in adapive robot control. Staionary and known objects are irst removed from the scene for eicient detecion of obstacles in a monitored area. The collision detecion is processed between a virtual model driven by real sensors, and 3D point cloud data of obstacles to allow diferent safety scenarios. The results show that this approach can be applied to real-ime work cell monitoring. (20 refs, 13 igs, 1 table) (AA)

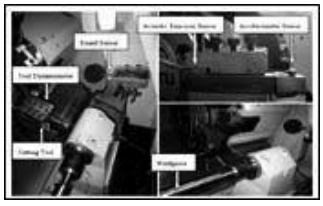
TOOLS & TOOLING

110456 Receptance coupling for tool point dynamic predicion by ixed boundaries approach [30]



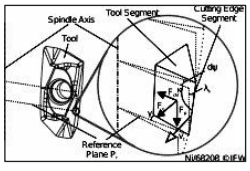
Mancisidor, Iker; Urkiola, Aitor; Barcena, Rafael; Munoa, Jokin; Dombovari, Zoltan; Zatarain, Mikel *[Int J of Machine Tools & Manufacture, v 78, Mar 2014, Staring Page 18, Pages 12]* The material removal capability of machines is parially condiioned by self-excited vibraions, also known as chater. In order to predict chater free machining condiions, dynamic transfer funcion at the tool ip is required. In many applicaions, such as high-speed machining (HSM), the problemaic modes are related to the lexibility of the tool, and experimental calculaion of the Frequency Response Funcion (FRF) should be obtained considering every combinaion of tool, toolholder and machine. Therefore, it is a ime consuming process which disturbs the producion. The bibliography proposes the Receptance Coupling Substructure Analysis (RCSA) to reduce the amount of experimental tests. In this paper, a new approach based on the calculaion of the ixed boundary dynamic behavior of the tool is proposed. Hence, the number of theoreical modes that have to be considered is low, instead of the high number of modes required for the models presented up today. This way, the Timoshenko beam theory can be used to obtain a fast predicion. The accuracy of this new method has been veriied experimentally for diferent tools, toolholders and machines. (24 refs, 14 igs, 8 tables) (AA)

110457 Monitoring the tool wear, surface roughness and chip formaion occurrences using muliple sensors in turning [31]



Bhuiyan, MSH; Choudhury, IA; Dahari, M *[J of Manufacturing Systems, v 33, n 4, Oct 2014, Staring Page 476, Pages 12]* Tool wear, chip formaion and surface roughness of workpiece under diferent cuing condiions have been invesigated in machining using acousic emission (AE) and vibraion signature in turning. The invesigaion has shown that the AE and vibraion components can efecively respond to the diferent occurrences in turning including tool wear and surface roughness. The AE has shown a very signiicant response to the tool wear progression whereas the resultant vibraion (V) represented the surface roughness in turning. The vibraion components Vx, Vy and Vz described the chip formaion type and are found to have the most signiicant response to the change of feed, depth of cut and cuing speed respecively. The amplitude of vibraion components, Vx, Vy and Vz increased with the increase of feed rate, depth of cut and cuing speed respecively. Even though the frequency of diferent signal components luctuated at the diferent stages of tool wear and at diferent cuing condiions, the frequency of vibraion components was always within a band of 98–40 kHz, and the AE has varied between 51 kHz and 620 kHz. (31 refs, 6 igs, 3 tables) (AA)

110458 Ideniicaion of the speciic cuing force for geometrically deined cuing edges and varying cuing condiions [32]



Denkena, Berend; Vehmeyer, Jost; Niederwestberg, Daniel; Maaß, Peter *[Int J of Machine Tools & Manufacture, v 82-83, Jul-Aug 2014, Staring Page 42, Pages 8]* Cuing force modeling is a major discipline in the research of cuing processes. The exact predicion of cuing forces is crucial for process characterizaion and opimizaion. Semi-empirical and mechanisic force models have been established, but the ideniicaion of the speciic cuing force for a pair of tool and workpiece material is sill challenging. Exising approaches are depending on geometrical idealizaions and on an extensive calibraion process, which make pracical and industrial applicaion diicult. For nonstandard tools and ive axis kinemaics there does not exist a reasonable soluion for the ideniicaion problem. In this paper a co-operaive force model for the ideniicaion of the speciic cuing forces and predicion of integral forces is presented. The model is coupled bidirecionally with a muli-dexel based material removal model that provides geometrical contact zone informaion. The nonlinear speciic forces are modeled as polynomials of uncut chip thickness. The presented force model is not subjected to principal restricions on tool shape or kinemaics, the speciic force and phase shit are ideniied with help of least square minimizaion. The beneit of this technique is that no special calibraion experiments are needed anymore, which qualiies the method to determine the speciic forces simultaneously during the machining process. In this paper, experiments with diferent cuing condiions are analyzed and systemaically rated. Finally, the method is validated by experiments using diferent cuing condiions. (15 refs 10 igs) (AA)

TRIBOLOGY

110459 Feasibility of lignin as addiive in metalworking luids for micro-milling [33]

Zhang, Yanqiao; Jun, Marin BG *[J of Manufacturing Processes, v 16, n 4, Oct 2014, Staring Page 503, Pages 8]* In this paper, lignin is dissolved in 5% convenional MWF aqueous soluions in 8 diferent concentraions through injecion and atomizaion methods. Then, experiments are conducted to evaluate the efeciveness of lignin containing MWFs in micro-milling operaions. The performance is compared with that of 5% convenional cuing luid in terms of machining forces, tool wears, and burr formaions. The results show that the concentraion of 0.015% lignin leads to the least cuing forces, tool wear and burrs. The results also show that an appropriate concentraion of lignin in MWFs can help to improve the cooling and lubricaion performances during machining. The results of this paper thus indicate that lignin has a potenial to be used as an addiive in metalworking luids. (14 refs, 14 igs, 1 table)(GM) ◘

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