Green manufacturing

From Appropedia

Contents

- 2.2.1 Why Carbon Reporting is a Growth Industry: Metrics for Measuring Carbon Emissions are Increasingly Important
- 2.2.2 Economics, environment, and energy life cycle assessment of automobiles fueled by bio-ethanol blends in China
- 2.2.3 A framework for modern manufacturing economics
- 2.2.4 Fuzzy geometric programming approach to a fuzzy machining economics model
- 2.2.5 Optimal solutions for the machining economics problem with stochastically distributed tool lives
- 2.2.6 Product Life Cycle Economic Models
- 2.2.7 Optimal Lot-Sizing and Machining Economics
- 2.2.8 An economic model for the machining of cast parts
- 2.2.9 Optimization of the Second-Order Logarithmic Machining Economics Problem by Extended Geometric Programming Part II: Posynomial Constraints
- 2.2.10 Economic analysis of machining including a consideration of tool life scatter
- 2.2.11 Economic considerations in tolerance design
- 2.2.12 The performance-envelope concept in the economics of machining
- 2.2.13 STUDY OF ECONOMICAL MACHINING: AN ANALYSIS OF THE MAXIMUM-PROFIT CUTTING SPEED

- 2.3 Environment, Energy and Manufacturing
  - 2.3.1 Robust optimisation of machining conditions with tool life and surface roughness uncertainties.
  - 2.3.2 Energy conservation potential in Taiwanese textile industry
  - 2.3.3 The effect of environmental uncertainty on supply chain integration in Chinese manufacturing industry
  - 2.3.4 A System Dynamics Model for the Environment Management of Eco-Industrial Park
  - 2.3.5 Energy Model for manufacturing process: A case study of wind turbine
  - 2.3.6 Applying CES to assembly and comparing carbon footprints.
  - 2.3.7 Eco-Innovation in Industry

- 2.3.8 Carbon footprinting upstream supply chain for electronics manufacturing and computer services
- 2.3.9 Impact of energy efficiency on computer numerically controlled machining
- 2.3.10 Carbon weight analysis for machining operation and allocation for redesign
- 2.3.11 COLD START FOR THE GREEN INNOVATION MACHINE
- 2.3.12 States and Trends of the Carbon Market 2009
- 2.3.13 A generic energy consumption model for decision making and energy efficiency optimisation in manufacturing
- 2.3.14 Life cycle engineering: Applying life cycle knowledge to engineering solutions
- 2.3.15 Process chain simulation to foster energy efficiency in manufacturing
- 2.3.16 A customer value model for sustainable service design
- 2.3.17 Proposal of sustainable society scenario simulator
- 2.3.18 Simulation-based sustainable manufacturing system design
- 2.3.19 Using Micro-data for the Assessment of Carbon Emissions in the New Zealand Manufacturing Industry (2008)
- 2.3.20 Metal forming progress since 2000,
- 2.3.21 Product conceptual design based on the idea of sustainable design
- 2.3.22 Carbon emissions and CESTM in manufacturing.
- 2.3.23 A carbon emission signature for products
- 2.3.24 A perspective on manufacturing strategy: Produce more with less
- 2.3.25 Environmental analysis of the Product Life Cycle by using an aggregated metric based on exergy
- 2.3.26 Smart Machining Systems: Robust Optimization and Adaptive Control Optimization for Turning Operations
- 2.3.27 Green Manufacturing: An Evaluation of Environmentally Sustainable Manufacturing Practices and Their Impact on Competitive Outcomes
- 2.3.28 Positive Trends and Opportunities for Sustainable Design in Operations Management Textbooks

Background

This will contain an overview of efforts made in manufacturing greener goods. Please leave comments or suggested works that should be added to this list in the "Discussion" tab at the top of the page. Alternatively you can send an email at: brankerk@me.queensu.ca

This Literature Review also at : http://www.tiptheplanet.com/wiki/Green_Manufacturing

Notes:

- Companies and consulting firms have their own cost models for optimization that is not open access to improve green manufacturing.

Environment and Economics in Manufacturing: Outline

Thoughts: Why save energy or reduce CO2?
Fossil fuels are being depleted.We continue to find alternative sources of energy to continue to meet our energy demands. Conservation and more efficient use of energy will help us have a sustainable energy consumption. Thus, even if we replace fossil fuels with alternatives, sustainable energy consumption is a goal since all sources have externalities, even if not CO2. Further, there are always cost savings to be had if energy consumption is reduced and abatement technologies are required less.

For CO2, accumulation is the problem. Although reducing CO2 emissions in the short term, burning all fossil fuels will result in putting the same amount eventually into the atmosphere. Here, the rate matters and the assimilation capacity of the environment matters. All arguments aside, reducing

carbon footprint, along with the other harmful externalities that come from fossil fuel use will benefit society. Reducing the return to oil extractors (either tax them or remove subsidies), and thus profits would reduce rate of extraction of oil from the supply side.This option is much more controversial due to the various stake holders and the choice of tax. Most instruments tackle this from the demand side - so consumers, such as manufacturing facilities, reduce their demand and so carbon footprint.

NOTE on cost of electricity increase for coal when emission controls in place: **Power Plants: Characteristics and Costs** Kaplan, S. (2008). Power Plants: Characteristics and Costs (http://www.fas.org/sgp/crs/misc/RL34746.pdf) . CRS Report for Congress, RL34746. Washington, DC: Congressional Research Service. [Full-text at http://bit.ly/d7M0Ja]

- Table 2. Emission Controls as an Estimated Percentage of Total Costs for a New Pulverized Coal Plant

News

Green Manufacturing: An Inconvenient Reality (2007)

Jonathan Katz,Green Manufacturing: An Inconvenient Reality (http://www.industryweek.com/articles/green_manufacturing_an_inconvenient_reality_13938.aspx) ,Industry Week, 3 pages.

- "Are you turning green at the thought of going green? Like it or not more environmental regulations are on the way, and manufacturers who don't jump on the green bandwagon may be left behind."
- "In 2004 the business sector shouldered 65% of environmental regulatory costs, with manufacturers paying an average of $4,850 per employee, according to a 2005 U.S. Small

Business Administration report."

May 1, 2007

Journals

- CIRP Annals
- Professional Engineering Publication: http://www.pepublishing.com/acadpub/acadjournals.htm
- IMechE: http://www.imeche.org/
- Journal of Engineering Sustainability
- International Journal of Sustainable Engineering : http://www.informaworld.com/smpp/title~content=g794528710~db=all

Literature Review

The links and abstracts of documents will be presented here. The link will only be accessible to those who have subscriptions to the respective journals. Add DOI: http://dx.doi.org.proxy.queensu.ca/

Manufacturing, Product Life Cycle, Sustainable Challenges

Sustainable green product design and manufacturing / assembly systems engineering principles and rules with examples

Ranky, Paul G.; , "Sustainable green product design and manufacturing / assembly systems engineering principles and rules with examples," Sustainable Systems and Technology (ISSST), 2010 IEEE International Symposium on , vol., no., pp.1-6, 17-19 May 2010 doi:

http://dx.doi.org.proxy.queensu.ca/10.1109/ISSST.2010.5507706
Abstract: Sustainable product and process engineering, green, lean design, manufacturing / assembly system and factory design / management rules and principles are offered with a focus on 'monozukuri'. The Japanese phrase, 'monozukuri' means sustainable, environmentally friendly, green factories and products with simultaneously integrated product and process designs. Based on the author's extensive research and study of products, processes and factories in the USA, Japan, Europe and China, eighteen 'monozukuri-focused' green product, process, factory design & management principles are explained. The rule-based approach introduced in this article, when integrated into an intelligent Sustainable Enterprise Engineering (iSEE:Green) design, will reduce waste at all levels, and create new eco-friendly (a.k.a. Earth-friendly), sustainable opportunities for satisfying rapidly changing market needs.

An integrated architecture, methods and some tools for creating more sustainable and greener enterprise

Ranky, Paul G.; , "An integrated architecture, methods and some tools for creating more sustainable and greener enterprises," Sustainable Systems and Technology (ISSST), 2010 IEEE International Symposium on , vol., no., pp.1-6, 17-19 May 2010 doi: 10.1109/ISSST.2010.5507696
Abstract: Sustainable green engineering design and manufacturing are changing every aspect of our life. This is because the climate is changing and customers are demanding sustainable green products and processes. Since many methods, designs and systems have to be changed, this is a complex field of integrated science and engineering, and we are only at the beginning… Sustainable green engineering has already attracted a wide area of research topics, including all aspects of energy management in every process step throughout the system's lifecycle, renewable energy creation and storage, all sorts of waste reduction methods, new approaches to risk analysis and customer requirements analysis, new biodegradable materials, sustainable non-toxic manufacturing processes and machinery, new levels of optimization in control systems, advanced digital design/manufacturing system simulation methods, sustainability statistics, human and machine error prevention, reuse,

recycling, and others. In this paper we offer an overview, as well as some methodology and concrete results.

An investigation of indicators for measuring sustainable manufacturing

Chengcheng Fan; Carrell, John D.; Hong-Chao Zhang; , "An investigation of indicators for measuring sustainable manufacturing," Sustainable Systems and Technology (ISSST), 2010 IEEE International Symposium on , vol., no., pp.1-5, 17-19 May 2010 doi: http://dx.doi.org.proxy.queensu.ca/10.1109/ISSST.2010.5507764

Abstract: This paper presents an investigation of sustainable manufacturing indicators in both industry and academia. While the concept of Sustainable Manufacturing has been brought up for a long time, little consensus has been researched so far with respect to how to define or measure it, especially in Economic and Social dimensions. This research tries to investigate current application status of sustainable indicators within U.S. manufacturing companies, and explore various views from academia in regards to weighting Economic / Social indicators through Analytic Hierarchy Process (AHP). The paper concludes with a summary of statistical results as well as recommendations for its further development and practical application.

Life-cycle carbon and cost analysis of energy efficiency measures in new commercial buildings

Joshua Kneifel, Life-cycle carbon and cost analysis of energy efficiency measures in new commercial buildings, Energy and Buildings, Volume 42, Issue 3, March 2010, Pages 333-340, ISSN 0378-7788, DOI: 10.1016/j.enbuild.2009.09.011.

Abstract: Energy efficiency in new building construction has become a key target to lower nation-wide energy use. The goals of this paper are to estimate life-cycle energy savings, carbon emission reduction, and cost-effectiveness of energy efficiency measures in new commercial buildings using an

integrated design approach, and estimate the implications from a cost on energy-based carbon emissions. A total of 576 energy simulations are run for 12 prototypical buildings in 16 cities, with 3 building designs for each building-location combination. Simulated energy consumption and building cost databases are used to determine the life-cycle cost-effectiveness and carbon emissions of each design. The results show conventional energy efficiency technologies can be used to decrease energy use in new commercial buildings by 20-30% on average and up to over 40% for some building types and locations. These reductions can often be done at negative life-cycle costs because the improved efficiencies allow the installation of smaller, cheaper HVAC equipment. These improvements not only save money and energy, but reduce a building's carbon footprint by 16% on average. A cost on carbon emissions from energy use increases the return on energy efficiency investments because energy is more expensive, making some cost-ineffective projects economically feasible.

Platform for the Integration of Assembly, Disassembly and Life Cycle Management

E. Westkamper, http://dx.doi.org.proxy.queensu.ca/10.1016/S0007-8506(07)61459-0 Platform for the Integration of Assembly, Disassembly and Life Cycle Management, CIRP Annals - Manufacturing Technology, Volume 51, Issue 1, 2002, Pages 33-36, .[1]

Abstract: Thinking in terms of product life cycles is one of the challenges facing manufacturers today: efforts to increase efficiency throughout the life cycle do not only lead to an extended responsibility of the concerned parties. As a result, economically successful business areas can be explored. Whether new service concepts are required, new regulations have been passed or consumers values are changing, the differences between business areas are disappearing. `Life Cycle Management' (LCM) considers the product life cycle as a whole and optimizes the interaction of product design, manufacturing and life cycle activities. The goal of this approach is to protect resources and maximize the effectiveness during usage by means of Life Cycle Assessment, Product Data Management, Technical Support and last but not least by Life Cycle Costing. This paper shows

the existing approaches of LCM and discusses their visions and further development.

Evaluation of Life Cycle Cost Analysis Methodologies

Senthil Kumaran Durairaj, S. K. Ong, A. Y. C. Nee, R. B. H. Tan, Evaluation of Life Cycle Cost Analysis Methodologies, Corporate Environmental Strategy, Volume 9, Issue 1, February 2002, Pages 30-39, ISSN 1066-7938, DOI: 10.1016/S1066-7938(01)00141-5. (http://www.sciencedirect.com/science/article/B6VNW-45C0X12-8/2/24b70247116f529a0b2c79e76f127134) Abstract: After the emergence of Life Cycle Engineering as an effective tool for analyzing the various environmental impacts of a product in the stages of design/development, manufacturing, service and disposal, a necessity arises to analyze the cost information pertaining to these impacts. There are possibly many approaches to analyze and evaluate the cost criteria involved in the different life cycle stages of any product or investment. This paper attempts to review many of those approaches methodologically, and specifically outline a practical framework that provides a new tool for evaluating all the eco-costs and developing a cost effective eco-design of any product.

Life Cycle Management and Assessment: Approaches and Visions Towards Sustainable Manufacturing

E. Westkamper, Alting, Arndt,^http://dx.doi.org.proxy.queensu.ca/10.1016/S0007-8506(07)63453-2¸Life Cycle Management and Assessment: Approaches and Visions Towards Sustainable Manufacturing (keynote paper), CIRP Annals - Manufacturing Technology, Volume 49, Issue 2, 2000, Pages 501-526, ISSN 0007-8506, DOI: .[2]

Abstract: Thinking in terms of product life cycles is one of the challenges facing manufacturers today: efforts to increase efficiency throughout the life cycle do not only lead to an extended responsibility of the concerned parties. As a result, economically successful business areas can be

explored. Whether new service concepts are required, new regulations have been passed or consumers values are changing, the differences between business areas are disappearing. 'Life Cycle Management' (LCM) considers the product life cycle as a whole and optimizes the interaction of product design, manufacturing and life cycle activities. The goal of this approach is to protect resources and maximize the effectiveness during usage by means of Life Cycle Assessment, Product Data Management, Technical Support and last but not least by Life Cycle Costing. This paper shows the existing approaches of LCM and discusses their visions and further development.

- Industrilization has allowed massive growth in posperity and manufactured capital
- Critical factors faced by society: 1) Rising consumption of natural resource, 2)exponential growth in population, 3)environmental impacts, 4)global commnication networks, 5) unstoppable globalization (changing paradigms)
- Production covers several phases in the life of technical products: Manufacturing, Usage and Service and Recycling
- Demand for life cycle management driven by need to balance economic, social, environmental and technical aspects- need for optmization of the production life cycle
- Manufacturers are responsible for their products over the complete life cycle.

Product Life Cycle Costing Applied to Manufacturing Systems

E. Westkamper, D.v.d. Osten-Sacken, Product Life Cycle Costing Applied to Manufacturing Systems, CIRP Annals - Manufacturing Technology, Volume 47, Issue 1, 1998, Pages 353-356, ISSN 0007-8506, DOI: 10.1016/S0007-8506(07)62849-2.

Abstract: Life Cycle Costing (LCC) supports the adaptation of product features, both consumer and capital goods, to their life cycle. The costs of production, installation, usage and disposal are analyzed and allocated, aiming at the minimum of the total cost. A new method to calculate the life cycle costs of capital goods, such as machines and manufacturing systems, is presented to anticipate the life cycle costs. Single processes connected to the product's life cycle are represented and described in a

potential-, program- and process-related way by the above mentioned life cycle costing method. Aiming on a redesign of current product structures, it is possible to derive approaches from the cost structures of the life cycle and also to create possibly new operational and maintenance concepts, as well as new financing models and cooperation forms.

Economics & Manufacturing

Why Carbon Reporting is a Growth Industry: Metrics for Measuring Carbon Emissions are Increasingly Important

Amanda Dahl, Why Carbon Reporting is a Growth Industry: Metrics for Measuring Carbon Emissions are Increasingly Important (http://green-business-practices.suite101.com/article.cfm/why-carbon-reporting-is-a-growth-industry) ,Mar 3, 2010, Suite 101

Companies are turning to specialized software for carbon emissions accounting in order to cope with pressure from regulators, clients and suppliers.

- Massaro, Traci. Groom Energy Research. Groom Energy Research Study Reveals 2009 Growth in Enterprise Carbon Accounting Software Market Research details latest market sizing, recent investments and acquisitions; selects emerging leaders for 2010. Published: 19 Jan 2010, http://www.groomenergy.com/files/2010_ECA_release_final.pdf

Economics, environment, and energy life cycle assessment of automobiles fueled by bio-ethanol blends in China

Zhiyuan Hu, Gengqiang Pu, Fang Fang, Chengtao Wang, Economics, environment, and energy life cycle assessment of automobiles fueled by bio-ethanol blends in China (http://dx.doi.org.proxy.queensu.ca/10.1016/j.renene.2004.03.014) , Renewable Energy, Volume 29,

Issue 14, November 2004, Pages 2183-2192

Abstract: This study examines the life cycle economics, environment impacts, and energy consumptions of Chinese automobiles fueled by bio-ethanol blends, utilizing life cycle assessment (LCA) techniques, and puts forward C, Env, En, EEE indicators to assess the economics, combined environmental impacts, energy consumption, and the balance of the three, as a means to evaluate whether the energy utilization efficiency and the domestic environment improvement are achieved at the lowest cost possible. A generic gasoline fueled car is used as a baseline case, and the cassava-based E85 fueled FFV in Guangxi is used as a case study. On the life cycle basis, the cost of cassava-based E85 fueled FFV is about 15% higher than that of gasoline fueled car, of which the two key factors are the price of cassava and gasoline, through a cost breakdown analysis. It also has lower life-cycle emissions of CO2, CO, HC, and PM pollutants, higher NOX emissions, while about 20% combined environment indicator is lower than that of the gasoline fueled car. And, it is higher in total energy consumption, lower in fossil fuels and petroleum consumptions, and has a better combined energy indicator. Lastly, the EEE indicator of the cassava-based E85 fueled FFV is about 29% less than that of the gasoline fueled car. Hence, E85 fueled FFV is a better vehicle than the gasoline fueled car, taking the balance of all the 3 'E's, the energy, environmental and economical aspects, into considerations.

A framework for modern manufacturing economics

Son, Y. (1991).A framework for modern manufacturing economics (http://www.informaworld.com/10.1080/00207549108948098) . International Journal of Production Research, 29(12), 2483-2499.

Modern manufacturing economics is an interdisciplinary research subject which deals with the cycles of performance measurement, cost estimation, and decision analysis that are enmeshed with quantification of ill-structured benefits of advanced manufacturing technologies (AMT). This paper proposes a framework of modern manufacturing economics by examining recent research trends of

AMT economics. It underscores integrated, quantitative, global, and strategic studies of AMT economics. 14 Jan 2010

Fuzzy geometric programming approach to a fuzzy machining economics model

Liu, S. -T. (2004). Fuzzy geometric programming approach to a fuzzy machining economics model (http://dx.doi.org.proxy.queensu.ca/10.1080/00207540410001691938) . International Journal of Production Research, 42(16), 3253-3269.

Abstract: Machining economics is an important function of the process planning activity for manufacturing products with high quality and low cost. The machining economics model usually contains a highly non-linear objective function and equations that could be formulated as a geometric programming problem. The paper develops a solution method for deriving the fuzzy objective value of the fuzzy machining economics problem when some of the parameters in the problem are fuzzy numbers. A pair of geometric programs is formulated to calculate the lower and upper bounds of the unit production cost at possibility level α. With the ability to calculate the fuzzy objective value developed, it might help lead to a more realistic modelling effort. The developed methodology can also be applied to other engineering design problems with fuzzy numbers.

12 Jan 2010

Optimal solutions for the machining economics problem with stochastically distributed tool lives

Eleftherios Iakovou, Chi M. Ip, Christos Koulamas, Optimal solutions for the machining economics problem with stochastically distributed tool lives (http://dx.doi.org.proxy.queensu.ca/10.1016/0377-2217(95)00131-X) , European Journal of Operational Research, Volume 92, Issue 1, 5 July 1996, Pages 63-68, ISSN 0377-2217, DOI: .
Abstract: This paper proposes analytical models and numerical procedures for simultaneously

determining the optimal cutting speed and tool replacement policy in machining economics problems with stochastic tool lives when the objective is the minimization of the machining cost per part. It is shown that the objective function is separable for certain phase type tool life distributions, including Gamma, which leads to an efficient solution procedure. Keywords: Machining economics; Manufacturing; Maintenance; Tool replacement

Product Life Cycle Economic Models

V.A. Tipnis, Product Life Cycle Economic Models (http://dx.doi.org.proxy.queensu.ca/10.1016/S0007-8506(07)62030-7) -- Towards a Comprehensive Framework for Evaluation of Environmental Impact and Competitive Advantage, CIRP Annals - Manufacturing Technology, Volume 40, Issue 1, 1991, Pages 463-466

Abstract: A quest for a comprehensive life cycle economic model has been launched, prompted by the need to know the cost of making products and processes environmentally safe as well as the need to evaluate alternate product and process designs before the first production run is made. Classical manufacturing cost models, cost and management accounting models, and microeconomic models are not adequate. Recently introduced micro- and macro- economic models of manufacturing processes provide cut and sequence level analysis. The constraint (bottleneck) model demonstrates the importance of bottlenecks for minimizing throughput time. Activity Based Costing is a welcome development from accounting discipline. Significant progress has been made in determining the penalty cost when products and processes fail in field and in production. The real challenge is to develop the model in such a manner that it becomes a valuable tool for designing products and processes robust, competitive, and environmentally safe to operate, dispose and recycle.

Optimal Lot-Sizing and Machining Economics

Christos P. Koulamas The Journal of the Operational Research Society, Vol. 41, No. 10 (Oct., 1990), pp. 943-952 (article consists of 10 pages) Published by: Palgrave Macmillan Journals on behalf of the

Operational Research Society Stable URL: http://www.jstor.org/stable/2583272

An economic model for the machining of cast parts

Pius J. Egbelu, Robert P. Davis, Richard A. Wysk, Jose M.A. Tanchoco, An economic model for the machining of cast parts (http://dx.doi.org.proxy.queensu.ca/10.1016/S0278-6125(82)80030-7) , Journal of Manufacturing Systems, Volume 1, Issue 2, 1982, Pages 207-213, ISSN 0278-6125

Abstract: A procedure for selecting a casting/machining strategy is presented. The procedure emphasizes the casting/machining process sequence rather than the mathematics of optimization that generally characterizes research in this class of problems. By using information readily available in most machine shops, the technique is practical, easy to implement, and requires a minimal amount of computational effort to arrive at a good solution strategy. 14 Jan 2010

Optimization of the Second-Order Logarithmic Machining Economics Problem by Extended Geometric Programming Part II: Posynomial Constraints

Hough, C. & Goforth, R. (1981). Optimization of the Second-Order Logarithmic Machining Economics Problem by Extended Geometric Programming Part II: Posynomial Constraints (http://dx.doi.org.proxy.queensu.ca/10.1080/05695558108974556) . IIE Transactions, 13(3), 234-242.

An algorithm is presented for solution of the machining economics problem with a Quadratic Posylognomial (QPL) objective function and single term posynomial constraints, meeting certain sufficient conditions. The algorithm applies to minimum cost or maximum productivity when the tool-life equation is a single term QPL and the removal rate is a single-term posynomial. A peripheral end-milling example, using the same tool-life equation and cost parameters as Part I, with the addition of experimentally derived constraints, is solved to illustrate the computational aspects of the algorithm. The QPL and posynomial (Taylor) formulations of the constrained machining problem are compared

using the same experimental tool-life data. The QPL formulation is based on a quadratic logarithmic model whereas the posynomial formulation is based on a linear logarithmic tool-life model. An optimum without active constraints is possible using the QPL formulation in several independent machining variables, such as feed, speed, and depth, whereas the posynomial optimum, by nature, requires active constraints for more than one independent variable. This is tantamount to having additional "degrees of freedom" for optimization, as illustrated by the example problem. 14 Jan 2010

Economic analysis of machining including a consideration of tool life scatter

G.L. Ravignani, Economic analysis of machining including a consideration of tool life scatter (http://dx.doi.org.proxy.queensu.ca/10.1016/0043-1648(80)90046-0) , Wear, Volume 62, Issue 1, July 1980, Pages 233-243, .
Abstract: Scatter in the wear rate and sudden fracture are often concomitant causes of premature tool failure. To control the economics of a machining process the related cutting conditions require to be selected according to a balanced estimate of expected results. Some mathematical relations including these modes of tool decay have been applied to newly established optimization procedures valid for the main economic objectives. The fundamentals of these techniques are briefly described and their implementation in machining economics is illustrated.

Economic considerations in tolerance design

Williams, R.H.; Hawkins, C. F., Economic considerations in tolerance design (http://dx.doi.org.proxy.queensu.ca/10.1109/ICEDTM.1994.496094) , Economics of Design, Test, and Manufacturing, 1994. Proceedings., Third International Conference on the , vol., no., pp.73-, 16-17 May 1994

Abstract: A method is presented which, from the customer's point of view, connects the quality with which an arbitrary number of manufacturing tolerances are met to the manufacturer's profit per unit. The method assumes specific quadratic forms to model customer satisfaction for the three major

tolerance types: nominal is best, less is better, and more is better. Theoretical and numerical examples are presented to illustrate the method for the cases of low and high quality in manufacture.
14 Jan 2010

The performance-envelope concept in the economics of machining

J.R. Crookall, The performance-envelope concept in the economics of machining (http://dx.doi.org.proxy.queensu.ca/10.1016/0020-7357(69)90003-1) , International Journal of Machine Tool Design and Research, Volume 9, Issue 3, ***September 1969***, Pages 261-278

Abstract: The performance-envelope concept, representing the permissible and desirable operating regions of machining, is developed for a particular combination of workpiece and tool. Analysis of cost and time provides an economic envelope bounded by the maximum and minimum production rates, and within which a choice of near-optimal operation is available. One objective is to utilize the flexibility which is a basic characteristic of machining. The effect of various constraints in limiting the operating range is examined, and include the machine tool in terms of range and power, and the tool-workpiece combination in terms of various tool failure modes, workpiece rigidity and surface roughness produced. Finally, experimental data is used to demonstrate the undesirable effects of operating near the built-up edge region, and also some aspects of the effect of the operating point on the nature and quality of the machine surface.

12 Jan 2010

STUDY OF ECONOMICAL MACHINING: AN ANALYSIS OF THE MAXIMUM-PROFIT CUTTING SPEED

Okushima, K. & Hitomi, K. (1964). A STUDY OF ECONOMICAL MACHINING: AN ANALYSIS OF THE MAXIMUM-PROFIT CUTTING SPEED (http://dx.doi.org.proxy.queensu.ca/10.1080/00207546408943046) . International Journal of

Production Research, 3(1), 73-78.
Apart from the conventional theory of the minimum-cost or maximum-production cutting speed, a new concept of the machining conditions for maximizing the profit for the manufacturing enterprise was presented. Based upon this concept, an analysts of the maximum-profit cutting speed was made and the theoretical expression for it was deduced.

Environment, Energy and Manufacturing

Robust optimisation of machining conditions with tool life and surface roughness uncertainties.

Hippalgaonkar, R. R. & Shin, Y. C. (2010). Robust optimisation of machining conditions with tool life and surface roughness uncertainties. International Journal of Production Research, doi:10.1080/00207543.2010.495207
The economics of the multi-pass turning problem is considered, while accounting for tool life uncertainty. The goal is to minimise the expected production cost per part, given the probability distribution for tool life, and with machining parameters being subject to practical constraints. The cost function accounts for machining cost, idling cost, tool changing cost as well as the cost associated with tool failure. A modified version of the particle swarm optimisation (PSO) algorithm, called the dynamic objective PSO (or DOPSO), is used for minimisation of the cost function. The decision variables include not only the machining parameters but also the tool replacement time. The equality constraint that the total desired depth of cut be achieved by an integral number of roughing passes and a single finishing pass is handled in a novel way, and together with including tool replacement time as a decision variable, this leads to lower costs than those cited by other comparable previous works. To handle uncertain constraints that lead to part failure when violated (e.g. desired surface finish), a robust formulation is also suggested through similar incorporation in the cost function, as for tool failure.

Energy conservation potential in Taiwanese textile industry

Gui-Bing Hong, Te-Li Su, Jenq-Daw Lee, Tsung-Chi Hsu, Hua-Wei Chen, Energy conservation potential in Taiwanese textile industry, Energy Policy, In Press, Corrected Proof, Available online 31 July 2010, ISSN 0301-4215, DOI: 10.1016/j.enpol.2010.07.024.
Abstract: Since Taiwan lacks sufficient self-produced energy, increasing energy efficiency and energy savings are essential aspects of Taiwan's energy policy. This work summarizes the energy savings implemented by 303 firms in Taiwan's textile industry from the on-line Energy Declaration System in 2008. It was found that the total implemented energy savings amounted to 46,074 ton of oil equivalent (TOE). The energy saving was equivalent to 94,614 MWh of electricity, 23,686 kl of fuel oil and 4887 ton of fuel coal. It represented a potential reduction of 143,669 ton in carbon dioxide emissions, equivalent to the annual carbon dioxide absorption capacity of a 3848 ha plantation forest. This study summarizes energy-saving measures for energy users and identifies the areas for making energy saving to provide an energy efficiency baseline.

The effect of environmental uncertainty on supply chain integration in Chinese manufacturing industry

Xu, Dehui; Zhao, Li; Li, Gang; Sun, Linyan; , "The effect of environmental uncertainty on supply chain integration in Chinese manufacturing industry," Service Systems and Service Management (ICSSSM), 2010 7th International Conference on , vol., no., pp.1-5, 28-30 June 2010 doi: 10.1109/ICSSSM.2010.5530165
Abstract: Supply chain integration nowadays is considered as an important approach to building and sustaining advantages. Many previous empirical researches focus on the effect of supply chain integration on the firms' performance, yet, the antecedence of supply chain integration is still largely unknown. This paper investigates the relationship between environmental uncertainty (including demand uncertainty, supply uncertainty and technology uncertainty) and supply chain integration (including customer integration, supplier integration and internal integration) with 139 samples from

Chinese manufacturing industry. The results reveal both supply uncertainty and technology uncertainty significantly influence supply chain integration; the effect of supply uncertainty is negative, while that of technology uncertainty is positive. However, demand uncertainty just has a significant effect on internal integration. The relationship between demand uncertainty and external integration (including customer integration and supplier integration) is mediated by the internal integration.

A System Dynamics Model for the Environment Management of Eco-Industrial Park

Qu, Qingling; Qian, Xin; Wang, Jin; , "A System Dynamics Model for the Environment Management of Eco-Industrial Park," Bioinformatics and Biomedical Engineering (iCBBE), 2010 4th International Conference on , vol., no., pp.1-4, 18-20 June 2010 doi: 10.1109/ICBBE.2010.5517238
Abstract: As industrial chain is important for the sustainability of an eco-industrial system, we formulate a system dynamic model emphasizing on importance of industrial chain. Taking machine manufacturing industry of Xuzhou Economic Development Zone for example, a system dynamic model including 6 flows (population, material, capital, technology, water, energy) is designed. By sensitivity analysis 3 sensitive parameters including technological investment ratio, network association degree, and diversity index are identified as sensitive parameters. Corresponding scenarios are simulated and suggestions on the sustainable development of the economic development are given.

Energy Model for manufacturing process: A case study of wind turbine

Bingbing Li; Hong-Chao Zhang; Qingdi Ke; , "Energy model for manufacturing process: A case study of wind turbine," Sustainable Systems and Technology (ISSST), 2010 IEEE International Symposium on , vol., no., pp.1-1, 17-19 May 2010, doi: http://dx.doi.org.proxy.queensu.ca/10.1109/ISSST.2010.5507700
AbstractThe energy consumption of manufacturing of wind turbine is largest impact contributor in

various characterization categories, based on the assessment of environmental effects during the whole life cycle of the wind turbine. The article discusses three important aspects of manufacturing processes to find out opportunities to improve energy efficiency while protecting the environment.

Applying CES to assembly and comparing carbon footprints.

Jeswiet, J. & Nava, P. (2009). Applying CES to assembly and comparing carbon footprints. (http://dx.doi.org.proxy.queensu.ca/10.1080/19397030903311957) International Journal of Sustainable Engineering, 2(4), 232-240.
A Carbon Emission Signature (CES) and a Carbon Emission Label have been proposed for manufactured products in previous CIRP (Collège International pour la Recherche en Productique) annals. This paper considers two things: (1) an example of a CES calculation for assembly with CO2 emissions and (2) the need for a transparent method of calculation. In comparing carbon footprint calculations for 17 websites, the results are found to vary more than threefold depending upon the site used and even more between different methods illustrating the need for standardisation in emission calculations for carbon accounting.

Eco-Innovation in Industry

Organization for Economic Co-operation and Development,OECD (2009).Eco-Innovation in Industry (http://browse.oecdbookshop.org/oecd/pdfs/browseit/9209061E.PDF) - Enabling green growth, pp 1-280.
Review: Eco-innovation will be a key driver of industry efforts to tackle climate change in the post-Kyoto era. This is perhaps the main conclusion published in a new book on green growth by OECD.It is based on a project on sustainable manufacturing and eco-innovation, which aims to accelerate sustainable industrial production through the diffusion of existing knowledge and the facilitation of the benchmarking of products and production processes.It also promotes the concept of eco-innovation

while stimulating new technological development and systemic solutions to global environmental challenges.

Carbon footprinting upstream supply chain for electronics manufacturing and computer services

Huang, Y.A.; Weber, C.L.; Matthews, H.S.; , "Carbon footprinting upstream supply chain for electronics manufacturing and computer services (http://dx.doi.org/10.1109/ISSST.2009.5156679) ," Sustainable Systems and Technology, 2009. ISSST '09. IEEE International Symposium on , vol., no., pp.1-6, 18-20 May 2009
Abstract: Corporations and institutions, including the electronics manufacturing and computer services sectors have become concerned with their impacts on climate change and are participating in carbon footprint assessment and climate management discussions. Existing carbon footprint protocols classify carbon footprint into tiered ldquoScopesrdquo: direct emissions as ldquoScope 1rdquo, emissions from direct purchased energy as ldquoScope 2rdquo, and all other indirect emissions as optional ldquoScope 3.rdquo Because Scopes 1 and 2 footprints are generally less than 25% of the total direct and upstream footprint for a vast majority of businesses, Scope 3 emissions should not be ignored as knowledge of them can help inform more holistic approaches to address life cycle footprint across the supply chain. This research uses input-output life cycle assessment methods to conduct a ldquoscoping analysisrdquo that characterizes the carbon footprint profiles of 8 electronics manufacturing and computer services sectors. The results show that there are significant variations in the portions of total analyzed footprint captured by each footprint Scope among this sector group. Most of the footprints for the electronics manufacturing sectors do not come from their Scope 1 emissions, but from the embodied emissions in the supplies of parts, components, chemicals, and materials. Purchases of food, air transportation, and hotel accommodation from employees traveling to customer locations are found to be the largest sources of upstream Scope 3 footprint for computer system design services sector. The results presented in this work are intended to inform footprinting entities and companies of the potential Scope 3 subcategories to focus their footprint efforts.

Impact of energy efficiency on computer numerically controlled machining

S E Anderberg, S Kara, T Beno,(2009)Impact of energy efficiency on computer numerically controlled machining (http://dx.doi.org.proxy.queensu.ca/10.1243/09544054JEM1712) , Journal Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, 2041-2975
Abstract: Increasing environmental demands from governmental bodies and customers stress the importance of companies improving their environmental performance. The research presented here shows that productivity and cost efficiency improvements can be achieved alongside energy savings in a computer numerically controlled machining environment. This improves the profitability of the companies, but also leads them towards more sustainable and environmentally aware manufacturing; the relationship between machining parameters, machining costs, and energy consumption is evaluated. From this perspective, it is important that production planners etc. understand the methodological possibilities for improvements in cost and energy efficiency. The current research is based on a machining cost model and experiments where energy consumption and tool wear were monitored.

Carbon weight analysis for machining operation and allocation for redesign

Ameta G, Mani M, Rachuri S, Feng SC, Sriram RD, Lyons KW. 2009. Carbon weight analysis for machining operation and allocation for redesign. (http://dx.doi.org.proxy.queensu.ca/10.1080/19397030903318226) International Journal of Sustainable Engineering 2(4):241-251. Accessed 2010 Jan 21.

Abstract: The objective of this research paper is to explore and develop a new methodology for computing carbon weight (CW) – often referred to as carbon footprint, in manufacturing processes from part level to assembly level. In this initial study, we focused on machining operations, specifically turning and milling, for computing CW. Our initial study demonstrates that CW can be computed using either actual measured data from process level information or from initial material and manufacturing process information. In mechanical design, tolerance analysis principles extend

from design to manufacturing and tolerances accumulate for parts and processes. By extending this notion to CW, we apply mechanical tolerancing principles for computing worst case and statistical case CW of a product. We call this the CW tolerance approach (CWTA). Two case studies demonstrate the computation of CW. Based on the tolerance allocation concepts; CW allocation is also demonstrated through specific redesign examples. CWTA helps in identifying carbon intensive parts/processes and can be used to make appropriate design decisions.

COLD START FOR THE GREEN INNOVATION MACHINE

P Aghion, R Veugelers, C Serre,COLD START FOR THE GREEN INNOVATION MACHINE (http://www.3evcloud.com/uploads/tx_btbbreugel/pc_climateparvcs_231109.pdf) Bruegel Policy Contribution, ISSUE 2009/12, NOVEMBER 2009

12 Jan 2010

States and Trends of the Carbon Market 2009

Capoor, K. and Ambrosi, P., 2009.States and Trends of the Carbon Market 2009 (http://wbcarbonfinance.org/docs/State___Trends_of_the_Carbon_Market_2009-FINAL_26_May09.pdf) , The World Bank, Washington DC, May.

21 Jan 2010

A generic energy consumption model for decision making and energy efficiency optimisation in manufacturing

Dietmair, Anton; Verl, Alexander. "A generic energy consumption model for decision making and energy efficiency optimisation in manufacturing (http://www.informaworld.com/10.1080/19397030902947041) Research Article" International

Journal of Sustainable Engineering 2(2), 123-133. (2009).

Today, energy efficiency in production systems has partially been achieved on the component level, but methods are missing for the energy optimal operation of plants, machines and components. We therefore, propose a novel generic method to model the energy consumption behaviour of machines and plants based on a statistical discrete event formulation. It is lean, integrative and scalable and can be used directly in planning processes to make predictions of the energy consumption of different configurations in different scenarios based on any amount of available information. Using the modelling framework, we introduce applications in real-time, tactical and strategic decision making processes that make it possible to exploit the potential for energy consumption minimisation of any given machine or production system while obeying conflicting general conditions. 14 Jan 2010

Life cycle engineering: Applying life cycle knowledge to engineering solutions

Sami Kara, Life cycle engineering: Applying life cycle knowledge to engineering solutions , CIRP Journal of Manufacturing Science and Technology, Volume 1, Issue 4, Life Cycle Engineering, 2009, Page 213

, ISSN 1755-5817, DOI: [1] (http://dx.doi.org.proxy.queensu.ca/10.1016/j.cirpj.2009.07.001)

Process chain simulation to foster energy efficiency in manufacturing

Christoph Herrmann, Sebastian Thiede, Process chain simulation to foster energy efficiency in manufacturing, CIRP Journal of Manufacturing Science and Technology, Volume 1, Issue 4, Life Cycle Engineering, 2009, Pages 221-229, ISSN 1755-5817, DOI: [2] (http://dx.doi.org.proxy.queensu.ca/10.1016/j.cirpj.2009.06.005) . Keywords: Sustainable manufacturing; Energy efficiency; Simulation; Process chain

A customer value model for sustainable service design

Koji Kimita, Yoshiki Shimomura, Tamio Arai, A customer value model for sustainable service design, CIRP Journal of Manufacturing Science and Technology, Volume 1, Issue 4, Life Cycle Engineering, 2009, Pages 254-261, ISSN 1755-5817, [3] (http://dx.doi.org.proxy.queensu.ca/10.1016/j.cirpj.2009.06.003) . Keywords: Service Engineering; Design support; Customer requirement; Customer value modeling; Service quality; Quality design

Proposal of sustainable society scenario simulator

Yasushi Umeda, Takeshi Nishiyama, Yasuhiro Yamasaki, Yusuke Kishita, Shinichi Fukushige, Proposal of sustainable society scenario simulator, CIRP Journal of Manufacturing Science and Technology, Volume 1, Issue 4, Life Cycle Engineering, 2009, Pages 272-278, ISSN 1755-5817, [4] (http://dx.doi.org.proxy.queensu.ca/10.1016/j.cirpj.2009.05.005) . (http://www.sciencedirect.com/science/article/B8JGX-4WK4310-2/2/b10c86ad0c9cab7f5ac070b25b29e6e0) Keywords: Sustainable manufacturing; Scenario; Sustainable society scenario simulator; Logical structure; Scenario analysis; Structural representation of scenarios; IPCC

Simulation-based sustainable manufacturing system design

Heilala, J.; Vatanen, S.; Tonteri, H.; Montonen, J.; Lind, S.; Johansson, B.; Stahre, J.; , Simulation-based sustainable manufacturing system design (http://dx.doi.org.proxy.queensu.ca/10.1109/WSC.2008.4736284) , Simulation Conference, 2008. WSC 2008. Winter , vol., no., pp.1922-1930, 7-10 Dec. 2008

Abstract: Manufacturing simulation and digital engineering tools and procedures have had a positive impact on the manufacturing industry. However, to design a sustainable manufacturing system, a multitude of system dimensions must be jointly optimized. This paper proposes an integrated simulation tool helping to maximize production efficiency and balance environmental constraints already in the system design phase. Lean manufacturing, identification and elimination of waste and

production losses, and environmental considerations are all needed during development of a sustainable manufacturing system. Engineers designing the manufacturing system need decision support, otherwise sub-optimization is more likely to occur. We present methods for calculating energy efficiency, CO2 emissions and other environmental impacts integrated into factory simulation software.

Using Micro-data for the Assessment of Carbon Emissions in the New Zealand Manufacturing Industry (2008)

Martin Brown-Santirso and Nedra Fu, 2008,Using Micro-data for the Assessment of Carbon Emissions in the New Zealand Manufacturing Industry (http://og.ssb.no/iresmainpage/otherpapers/UsingMicrodatafortheassessmentofcarbonemissions.pdf) ,Paper presented at Markets and Models: Policy Frontiers in the AWH Phillips Tradition,at Wellington, New Zealand,9-11 July 2008[3]

- This study also makes use of the Annual Enterprise Survey (AES) unit record data to

directly compare the intermediate consumption values for each enterprise against costs of carbon emissions at several carbon price scenarios ($15, $25, $50 and $100 dollars per tonne). Thus, the study generates an estimate of the added cost of production that arises from energy related carbon emissions for each enterprise.

Metal forming progress since 2000,

J. Jeswiet, M. Geiger, U. Engel, M. Kleiner, M. Schikorra, J. Duflou, R. Neugebauer, P. Bariani, S. Bruschi, Metal forming progress since 2000, CIRP Journal of Manufacturing Science and Technology, Volume 1, Issue 1, 2008, Pages 2-17, ISSN 1755-5817, DOI: [5] (http://dx.doi.org.proxy.queensu.ca/10.1016/j.cirpj.2008.06.005) . Keywords: Metal forming

Product conceptual design based on the idea of sustainable design

Qun Huang; Nana Zhang; , "Product conceptual design based on the idea of sustainable design," (http://dx.doi.org/10.1109/CAIDCD.2008.4730592) Computer-Aided Industrial Design and Conceptual Design, 2008. CAID/CD 2008. 9th International Conference on , vol., no., pp.377-379, 22-25 Nov. 2008 Abstract: The statement of sustainable design transcends original idea of product design, and has new requirements of the process of product design and impact on environment. Product conceptual design is the core of product innovation. And conceptual development of products and design of products decisively influence product detailed design, product manufacturing development, product market development as well as the realization of enterprisesÂ¿ business strategic goal in the process of product innovation. This article mainly elaborate the importance of following the idea of sustainable design from design connotations, design principles and design purpose of product conceptual design, thus able to shorten the disparity of conceptual design and changes in the market, so that conceptual products made by product conceptual design can be a great degree of putting on the market and be successful.

Carbon emissions and CESTM in manufacturing.

Jeswiet, J. and Kara, S., 2008. Carbon emissions and CES (TM) in manufacturing. (http://dx.doi.org.proxy.queensu.ca/10.1016/j.cirp.2008.03.117) CIRP Annals - Manufacturing Technology, 57 (1), 17–20.
Abstract: The manufacturing of a product is connected directly to the amount of carbon emitted in producing electrical energy for that manufacturing process. A new, simple Carbon Emission Signature, CES(TM), is proposed. Knowing the CES for a power grid and the energy needed to make a part, the carbon emitted can be found. Examples of single point turning and open die forging are given. Knowing the total carbon emitted for a product, a manufacturer can place a Green House Gas (GHG) label on each product. A customer can then see the amount of Green House Gas emitted in making the product.

A carbon emission signature for products

Transactions of the North American Manufacturing Research Institution of SME [1047-3025] Jeswiet yr.2008 pg.317 -324

A perspective on manufacturing strategy: Produce more with less

G. Chryssolouris, N. Papakostas, D. Mavrikios, A perspective on manufacturing strategy: Produce more with less, CIRP Journal of Manufacturing Science and Technology, Volume 1, Issue 1, 2008, Pages 45-52, ISSN 1755-5817, DOI:[6] (http://dx.doi.org.proxy.queensu.ca/10.1016/j.cirpj.2008.06.008) . Keywords: Manufacturing; Environment; Production efficiency; Materials; Manufacturing processes; Recycling; Information technology

Environmental analysis of the Product Life Cycle by using an aggregated metric based on exergy

Coatane´a, E., Kuuva, M., Makkonen, P. and Saarelainen, T.,2007. Environmental analysis of the Product Life Cycle by using an aggregated metric based on exergy (http://dx.doi.org.proxy.queensu.ca/10.1504/IJPLM.2007.018297) International Journal of Product Lifecycle Management, 2 (4),337–355.

Abstract: Environmental accountancy and environmental impacts analysis are characterised by fragmented approaches encompassing a number of different perspectives and analytical techniques. Although Life Cycle Assessment (LCA) method is the most commonly used tool by which environmentally conscious design is carried out, the scientific reliability of LCA techniques has been questioned. Indeed, LCA techniques include limitations such as a lack of adequate inventory data, disparate underlying assumptions and environmental assessment made in terms that are not directly

comparable. Those restrictions limit the applicability of LCA methods during early development stages. This article addresses this shortcoming by outlining previous researches in life cycle analysis and thermodynamics. It is argued herein that the early development phases require a simplified approach based on exergy. It is argued that the concept of exergy is a broad-based measure assessing the environmental impact and resource consumption of the Product Life Cycle (PLC). In addition, the article addresses a more ambitious research problem by integrating environmental impact and resource consumption into a broader design framework, described briefly in this article. The aim of the design framework presented herein is to optimise the comparison and evaluation process, which ends the early design process. This is in our viewpoint the first step of our work toward unified design theory based on topological principles.

21 Jan 2010

Smart Machining Systems: Robust Optimization and Adaptive Control Optimization for Turning Operations

Ivester, R. and Heigel, J., (2007), Smart Machining Systems (http://smartmachiningsystems.com/Papers/ICSMS2007-HeigelIvester_final.pdf) : Robust Optimization and Adaptive Control Optimization for Turning Operations, Transactions of NAMRI/SME, Vol. 35, pp. 502 - 512

Cutting force models, often developed from a narrow set of empirical data, provide insight into the physical properties of cutting, but the extreme physical phenomena of metal cutting and the many uncertainties in an industrial setting (machine tool, workpiece material, tooling, environmental conditions) hinder predictability. In order to improve the practicality of model-based decision making in an industrial machining environment, this paper introduces a method to adapt parameters of a traditional empirical model in response to on-line measures of process performance. This method enables Smart Machining Systems to self-monitor production performance and adapt models and process parameters to the conditions encountered in production environments, reducing the need for

expensive empirical tests.

Green Manufacturing: An Evaluation of Environmentally Sustainable Manufacturing Practices and Their Impact on Competitive Outcomes

Rusinko, C.A.; ,[7] (http://dx.doi.org.proxy.queensu.ca/10.1109/TEM.2007.900806) "Green Manufacturing: An Evaluation of Environmentally Sustainable Manufacturing Practices and Their Impact on Competitive Outcomes," Engineering Management, IEEE Transactions on , vol.54, no.3, pp.445-454, Aug. 2007
Abstract: Increasingly, stakeholders are asking or requiring organizations to be more environmentally responsible with respect to their products and processes; reasons include regulatory requirements, product stewardship, public image, and potential competitive advantages. This paper presents an exploratory study of the relationships between specific environmentally sustainable manufacturing practices, and specific competitive outcomes in an environmentally important but under-researched industry, the U.S. commercial carpet industry. In general, empirical research on the impact of environmental practices on organizational outcomes is inconclusive, partly due to limitations of earlier studies. This paper addresses some of these limitations, and surveys the entire U.S. commercial carpet industry; respondents represent 84 of the market. Findings suggest that environmentally sustainable manufacturing practices may be positively associated with competitive outcomes. In particular, different types of environmentally sustainable manufacturing practices (e.g., pollution prevention, product stewardship) are associated with different competitive outcomes (e.g., manufacturing cost, product quality). These specific findings can be helpful to engineering and operations managers as they respond to environmental and competitive demands.

Positive Trends and Opportunities for Sustainable Design in Operations Management Textbooks

Stuart Williams, J.A.; , "Positive Trends and Opportunities for Sustainable Design in Operations

Management Textbooks With Examples from the Electronics Industry (http://dx.doi.org/10.1109/ISEE.2007.369367) ," Electronics & the Environment, Proceedings of the 2007 IEEE International Symposium on , vol., no., pp.57-60, 7-10 May 2007
Abstract: In recent editions of operations management textbooks, sections have been added on topics related to sustainable design. Many of the textbook discussions illustrate design for environment, remanufacturing, and recycling with examples from the electronics industry. Building on this positive trend, this paper points out how educators can further enhance student learning by expanding existing exercises and discussions with additional resources. The paper concludes with a call to integrate sustainable design concepts into operations management and other non-environmental engineering fields that impact product design.

Electrical Energy Requirements for Manufacturing Processes

Timothy Gutowski, Jeffrey Dahmus, and Alex Thiriez,Electrical Energy Requirements for Manufacturing Processes (http://web.mit.edu/ebm/www/Publications/CIRP_2006.pdf) ,13th CIRP International Conference on Life Cycle Engineering, Leuven, May 31st – June 2nd, 2006, pp 623 -627

AbstractThis paper collapses the specific electrical energy requirements for a wide range of manufacturing processes into a single plot. The analysis is cast in an exergy framework. The results show: 1) the specific energy requirements for manufacturing processes are not constant as many life cycle analysis tools assume, 2) the most important variable for estimating this energy requirement is the process rate, and 3) the trend in manufacturing process development is toward more and more energy intensive processes. The analysis presented here also provides insight into how equipment can be redesigned in order to be more energy efficient. 26 Feb 2010

An environmental analysis of machining.

Dahmus, J. and Gutowski, T., 2004. An environmental analysis of machining. Proceedings of the 2004 ASME International Mechanical Engineering Congress and RD&D Exposition, Anaheim, CA, 13–19

November.

- find article!

21 Jan 2010

A new eco-design strategy to assess sustainable environmental innovations

Jofre, S.; Tsunemi, K.; Morioka, T.; , "A new eco-design strategy to assess sustainable environmental innovations (http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1322642&isnumber=29286) ," Environmentally Conscious Design and Inverse Manufacturing, 2003. EcoDesign '03. 2003 3rd International Symposium on , vol., no., pp. 81- 88, 8-11 Dec. 2003
Abstract: This paper analyzes and discusses the potential role of evolutionary theories in environmental innovation with emphasis on sustainability. The study focuses on the dynamic mechanisms driving the adaptation of products to their changing environments. As a result, a strategy, called Eco-evolution, is proposed. Eco-evolution is a strategy based on incremental innovation through re-examination of existent knowledge and technological trajectories. The strategy attempts the identification of lock-in of non-optimal technologies and sustainable alternatives, in order to outline the sustainable design and organizational horizons. To illustrate the practical application of the strategy, an example based on domestic refrigerators is included. The study concludes that eco-evolution is efficient when identifying non-optimal technological trajectories and sustainable options for innovation on the basis of existent knowledge.

Eco-value as an indicator for sustainable design

Fumikazu, M.; Satsuki, K.; Naoki, L.; Kengo, K.; Rei, S.; Kenji, Y.; Satoko, W.; Risa, U.; Katsura, E.; Tomohisa, K.; Tsuneya, K.; Tomoya, S.; Takuya, S.; Mie, S.; Masashi, S.; Kenji, T.; Chie, T.; Yusuke, N.; Akiko, N.; Rie, H.; Nobuko, H.; Kiyotaka, H.; Kana, H.; Masashi, Y.; ,"Eco-value as an indicator for sustainable design (http://dx.doi.org/10.1109/.2001.992532) ," Environmentally Conscious Design

and Inverse Manufacturing, 2001. Proceedings EcoDesign 2001: Second International Symposium on , vol., no., pp.1106-1109, 2001
Abstract: The ideal sharing system should lower environmental impact by reducing a total amount of production and consumption, and this could be achieved by the shift in human desire for products. More emphasis on shared products' function supports the ideal sharing system for coorect operation. Industrial designers should promote this shift in life style by providing attractive and sustainable design with people

Computer-aided economic optimization of end-milling operations

J. Wang, Computer-aided economic optimization of end-milling operations (http://dx.doi.org.proxy.queensu.ca/10.1016/S0925-5273(98)00008-5) , International Journal of Production Economics, Volume 54, Issue 3, 18 May 1998, Pages 307-320

Abstract: Optimization analysis, strategy and CAM software for single pass end-milling on CNC machine tools are outlined and discussed based on criteria typified by the maximum production rate and allowing for a range of machine tool and component surface roughness constraints. It is shown that the deterministic optimization approach involving mathematical analyses of constrained economic trends and their graphical representation on the feed-speed domain provides a deeper understanding of the influences of constraints and a clearly defined strategy which guarantees the global optimum solutions. Numerical simulation studies have amply demonstrated the economic benefits of using this strategy over handbook recommendations as well as in assessing, selecting and improving machine tool design specifications.

14 Jan 2010

On the optimization of machining parameters for milling operations

M. Tolouei-Rad, I. M. Bidhendi, On the optimization of machining parameters for milling operations

(http://dx.doi.org.proxy.queensu.ca/10.1016/S0890-6955(96)00044-2) , International Journal of Machine Tools and Manufacture, Volume 37, Issue 1, ***January 1997***, Pages 1-16

Abstract: Owing to the significant role that machining parameters play in performing successful and efficient machining operations, determination of the best or optimum machining parameters is still the subject of many studies. The need to use optimum machining parameters to improve machining efficiency is of greater importance when NC machines with high capital cost are employed. This paper describes development and utilization of an optimization system which determines optimum machining parameters for milling operations. These parameters are intended for use by NC machines, however, they can also be used by conventional machines. The paper discusses both single-tool and multi-tool milling operations where emphasis has been placed on the latter. An example has been presented at the end of the paper to give a clear picture from the application of the system and its efficiency.

12 Jan 2010

Manufacturing Engineering and Technology.

Kalpakjian, S., 1995. Manufacturing Engineering and Technology.3rd ed. Reading, MA: Addison-Wesley. [8] (http://elib.tu-darmstadt.de/tocs/133140288.pdf)

Applications of life cycle assessment: expectations, drawbacks and perspectives.

Helias A. Udo de Haes, Applications of life cycle assessment: expectations, drawbacks and perspectives. (http://dx.doi.org.proxy.queensu.ca/10.1016/0959-6526(93)90002-S) , Journal of Cleaner Production, Volume 1, Issues 3-4, 1993, Pages 131-137

Abstract: In this article an overview is given of present applications of life cycle assessment (LCA) as

an instrument for the support of decision-making. Attention is given to original expectations, present drawbacks and future perspectives. The following dimensions are chosen for this overview: the main users, with a distinction between governments, companies and non-governmental organizations; the level of sophistication, distinguishing between LCA as a concept, qualitative LCA and quantitative LCA, with varying degrees of detail within the latter; a distinction between applications at an operational and at a strategic level; a distinction between internal and external applications; and finally the level of completeness of the study, i.e. which limitations are set a priori for a study. Three types of drawbacks are encountered: purely technical problems, methodological problems and communication problems. Possible ways to cope with these are discussed.

21 Jan 2010

Integrated End Milling Optimization Development

V.A. Ostafiev, A.V. Globa, L.S. Globa, T.N. Loladze,Integrated End Milling Optimization Development (http://dx.doi.org.proxy.queensu.ca/10.1016/S0007-8506(07)61373-0) , CIRP Annals - Manufacturing Technology, Volume 33, Issue 1, 1984, Pages 29-32

Abstract: Integrated method of end milling has been developed to optimize both cutter path, type of tools, number of outs and cutting conditions. Method of Data Handling by Groups(MDHG) was used to set up a model for complex non-homogeneos systems with minimum data applied. Machining analytical introduction carrying from manufacturing process data directly with reliable accuracy was got by MDHG. For creating technological process variables relationships now used manufacturing statistics taking in account the shop production conditions. Two stages iterative mode interacting was carried out for optimization process: 1- the process structure has been optimized by cutter path, type of tools and number of cuts;2- using nonlinear programming the generalized Lagrange Multiplier Method for cutting condition optimization. Increase shop production rate has been confirmed by the method proposed. 14 Jan 2010

Environmental/Economic Considerations

Reflections on the economics of climate change

Nordhaus WD. Reflections on the economics of climate change. Journal of Economic Perspectives (1993); 7(4) 11-25 at 15

An optimal transition path for slowing climate change

Nordhaus WD. An optimal transition path for slowing climate change. Science 1992; 258: 1315-19.

Emissions Trading and NOx and SOx Emissions Limits for Ontario's Electricity Sector

Ontario Ministry of the Environment. (2007)[Emissions Trading and NOx and SOx Emissions Limits for Ontario's Electricity Sector.][9] (http://www.ecoissues.ca/wiki//index.php?title=Emissions_Reduction_Trading_and_NOx_and_SO2_Emission_Limits_for_the_Electricity_Sector) [10] (http://www.ene.gov.on.ca/envision/env_reg/er/documents/2001/RA01E0020-C.pdf)

regulation of SOx and NOx means using equipment to contain or reduce emissions. Reducing energy use also reduces the costs associated with these.

Environmental Externalities in Electric Power Markets: Acid Rain, Urban Ozone, and Climate Change

J. Carlin. (2002) Environmental Externalities in Electric Power Markets (http://www.eia.doe.gov/cneaf/pubs_html/rea/feature1.html) : Acid Rain, Urban Ozone, and Climate Change. Energy Information Administration.

Electric power plants that burn fossil fuels emit several pollutants linked to the environmental problems of acid rain, urban ozone, and the possibility of global climate change. Damages caused by those emissions are viewed by many economists as "externalities" and an inefficiency of the market when electric power rates do not reflect, nor ratepayers directly pay, the associated social costs. Until recently, efforts to control power plant emissions have focused on the command-and-control approach of setting standards. More recent efforts, including the Clean Air Act Amendments of 1990, have involved incentive-based measures, such as emissions fees and systems of marketable emissions allowances. A few State regulatory bodies are experimenting with methodologies to "price" environmental externalities and incorporate that cost information in deliberations about least-cost ways to meet projected demand for electric power. The spread of these methodologies could be affected by increased competition in the electricity industry, which would allow electric power customers direct access to a variety of electric power providers.

The Role of Economics in Climate Change Policy

Mckibbin, Warwick and Wilcoxen, Peter J, (2002), The Role of Economics in Climate Change Policy (http://econpapers.repec.org/RePEc:aea:jecper:v:16:y:2002:i:2:p:107-129) , Journal of Economic Perspectives, 16, issue 2, p. 107-129.

Abstract: The most important characteristic of climate change as a policy problem is uncertainty. From climatology to economics, uncertainties are pervasive, large and difficult to resolve. However, the economic theory of environmental policy under uncertainty provides a clear guide to the design of an appropriate policy. An efficient and practical approach would be a hybrid that incorporates the best features of tradable permits and emissions taxes. Unfortunately, international negotiations have taken a different approach, focusing on rigid targets and timetables for emissions reductions. The result has been the Kyoto Protocol, an agreement with no real chance of reducing greenhouse gas emissions.

Online Books

- Citizen Engineer
- Environmental Burden Analysis for Machining Operation Using LCA Method (http://dx.doi.org.proxy.queensu.ca/10.1007/978-1-84800-267-8_13) (book Chapter)
- Design for Competitive Advantage (http://spartan.ac.brocku.ca/~pscarbrough/dfca1stmods/dfc/toc.html)

"From a quantitative perspective, multidisciplinary optimization is a highly technical emerging discipline. It relies heavily on mathematics, statistics, operations research, computer science, software engineering, and all of the particular disciplines which fall within the scope of the particular problem to be solved. From a qualitative perspective, multidisciplinary optimization is an emerging discipline which encompasses quality, cost, value, and genopersistation."....."Activity based costing (ABC), while not perfect, does represent unit cost and lot cost much better than the old unit cost techniques. Thus, future parametric cost analysis should be based upon activity based costing. Here, the cost of an activity would be mapped to attributes of the system to bring forth, sustain, and retire the product and to attributes of the input and output of the activity. These attributes are called quality characteristics within quality function deployment. I call such models parametric activity based models."

Software

Machining Economics Calculator (http://www.toolingonline.com/download.mvc/Machining-Economics-Calculator-0001?VNETCOOKIE=NO) ,Sandvik Coromant Company <accessed Feb 24th, 2010>
OPENLCA [11] (http://sourceforge.net/projects/openlca/)
CMLCA

STELLA
POWERSIM
Netlogo
Starlogo
MATLAB
ANSYS
RADIOSS
Fortran
Solid Works (with LCA app)
GaBi

- LCA tools: http://lca.jrc.ec.europa.eu/lcainfohub/toolList.vm

Useful Links

Papers not bought:

1. Carbon Emission Signature for Products: http://www.sme.org/cgi-bin/get-item.pl?TP08PUB81&2&SME
2. Awaiting Paper: [12] (http://www.nist.gov/cgi-bin/view_pub.cgi?pub_id=904931&division=826) Development Overview of Sustainable Manufacturing Metrics

Climate Change and Regulation

1. The Pembina Institute: Climate Change [13] (http://climate.pembina.org/pub/1919)
2. Carbon taxing or trading [14] (http://www.sciencemag.org/cgi/content/short/314/5803/1217)
3. Sustainable Manufacturing Metrics [15]

(http://www.trade.gov/competitiveness/sustainablemanufacturing/metrics.asp)

Manufacturing

1. Green Manufacturing Blog (http://green-manufacturing.blogspot.com/)

Computing Carbon Weight, Footprint and Guideline

1. GHG Quantification Resources from Environment Canada (http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=DA0606FF-1)

1. Scheme for Computing Carbon Weight (footprint) for Manufactured Products Project, NIST (http://www.nist.gov/mel/msid/dpg/sccwmp.cfm)
2. Rapid Manufacturing May Deliver Carbon & Cost Savings (http://www.rapidtoday.com/Atkins.html) [16] (http://www.econolyst.kinetic-dev.net/pdf/publications/ZEEFSReportN0012J.pdf)
3. Carbon footprint of food packaging (http://smc.simtech.a-star.edu.sg/uploads/ak1444Qw/File/Carbon%20Footprint%20of%20Food%20Packaging.pdf)
4. Sustainable and Lifecycle Information-based Manufacturing (http://www.nist.gov/mel/msid/dpg/slim.cfm)
5. A definition of carbon footprint (http://www.censa.org.uk/docs/ISA-UK_Report_07-01_carbon_footprint.pdf)
6. An Exploration of the Structure and Development of Carbon Footprint Analysis (http://www.spp.gatech.edu/faculty/WOPRpapers/Logan.WOPR.pdf)
7. DEVOLVED MANUFACTURING (http://www.nex-gem.co.uk/AMEE/1Presentation6-July-06.pdf)

8. Measure Carbon Emissions (http://www.carbonoffsetsdaily.com/global/measure-carbon-emissions-if-you-want-to-be-green-3242.htm)
9. Carbon Footprint (http://knol.google.com/k/carbon-footprint?pli=1#)

Economics and Engineering

1. Linking Economic Model and Engineering Model: Application of Sequential Interindustry Model (SIM)[17] (http://magic.un.org.mx/www2/iadb-eclac-project/pdf/okuyama2002b.pdf)
2. Chapter in Manufacturing and Economics http://www.springerlink.com.proxy.queensu.ca/content/?k=+Economic+Model+Manufacturing+Costs+

1. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0100-73862000000200005
2. http://www.springerlink.com/content/h623263672273015/fulltext.pdf

United Nations Environment Programme (UNEP)

Intergovernmental Panel On Climate Change (IPCC)

Databases

- Global reporting initiative provides guidance for environmental and sustainable metrics:http://www.globalreporting.org/Home
  Facility reporting:
- Green House Gas Protocol calculators: http://www.ghgprotocol.org/calculation-tools/sector-toolsets
- EU LCA data: http://lct.jrc.ec.europa.eu/assessment/tools [18]

(http://lca.jrc.ec.europa.eu/lcainfohub/toolList.vm)
- LCA tools: http://lca.jrc.ec.europa.eu/lcainfohub/toolList.vm
- World Wide Steel life cycle inventory (LCI): http://www.worldsteel.org/index.php?action=newsdetail&id=286
- GreenSCOR: http://www.lmi.org/logistics/Documents/greenSupply/GreenSCOR%20White%20Paper.pdf [19] (http://cip.gmu.edu/research/Wilkerson_presentation_Sutainable%20Supply%20Chain.pdf)

- **Green Manufacturing Summit, 2008 (http://events.eyefortransport.com/manufacturing/)**

-HOW TO MEASURE AND REDUCE THE ENVIRONMENTAL IMPACT OF YOUR MANUFACTURING PROCESSES WHILE INCREASING EFFICIENCY AND PROFIT

- Carbon Pricing

- Life cycle analysis

Citations

1. ↑ E. Westkamper, Platform for the Integration of Assembly, Disassembly and Life Cycle Management, CIRP Annals - Manufacturing Technology, Volume 51, Issue 1, 2002, Pages 33-36, ISSN 0007-8506, DOI: 10.1016/S0007-8506(07)61459-0.
2. ↑ E. Westkamper, Alting, Arndt, Life Cycle Management and Assessment: Approaches and Visions Towards Sustainable Manufacturing (keynote paper), CIRP Annals - Manufacturing Technology, Volume 49, Issue 2, 2000, Pages 501-526, ISSN 0007-8506, DOI: 10.1016/S0007-8506(07)63453-2.

3. ↑ Martin Brown-Santirso and Nedra Fu, 2008,Using Micro-data for the Assessment of Carbon Emissions in the New Zealand Manufacturing Industry,Paper presented at Markets and Models: Policy Frontiers in the AWH Phillips Tradition,at Wellington, New Zealand,9-11 July 2008, http://og.ssb.no/iresmainpage/otherpapers/UsingMicrodatafortheassessmentofcarbonemissions.pdf

User:Kadra09