MANUFACTURING TECHNOLOGY

June 2012, Vol. 12, No. 12

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Cover sheet photos:
* Laser engineered net shaping (LENS) technology application, p. 78, authors: Novakova-Marcincinova Ludmila, Janak Miroslav
* ICPM 2013 Invitation – Miskolc, Hungary.

The journal is indexed in SciVerse Scopus by Elsevier.

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J. E. Purkyne University in Usti nad Labem
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Pasteurova 3334/7, 400 01 Usti nad Labem
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Print
PrintPoint Ltd., Prague, Czech Republic

Publisher
J. E. Purkyne University in Usti nad Labem
Horeni 13, 400 96 Usti nad Labem,
Czech Republic
VAT: CZ44555601

Issue: 200 pcs.
published in June 2012, 90 pages

Permission: MK CR E 20470

ISSN 1213–2489

indexed on: http://www.scopus.com

Science Without Borders SWB

Manufacturing Technology Journal
ISSN 1213–2489

Utilization of Open Source Application in Area of Augmented Reality Assembling Processes

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This chapter investigates the establishing process of virtual tool that in its logical core utilizes an approach based on the open source philosophy exploited for the work with the environment of augmented reality and its application in assembling processes. The traditional possibilities of how the engineer can use tools of augmented reality in form of normal commercial devices to collect the information about position of observed object in the working environment concern special devices with general structure formed by elements of motion tracking systems or technology of visual markers. In the beginning, the chapter briefly focuses on general problems in the application processes of virtual components and logical scripts in the area of the augmented reality. In following phase it provides fundamental philosophy and logical steps of new presented application of the augmented reality whereupon some samples can be provided created by means of logical operations and virtual elements from the open source environment. In the final step of this article chapter is clarified application process for creation and development of virtual software and hardware elements that are necessary for work in the augmented reality environment.

Keywords: Augmented Reality, Virtual environment, Open Source

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Acknowledgements

Ministry of Education, Science, Research and Sport of SR supported this work, contract VEGA No. 1/0036/09, KEGA No. 047-004TUKE-4/2010 and ITMS project 26220220125.

Paper number: M201201

Manuscript of the paper recieved in 2011-11-21. The reviewers of this paper: *Assoc. Prof. Dr. Ivan Mrkvica, MSc. and Prof. Dr. Frantisek Holesovsky, MSc.*

CAM in the Production of Casting Patterns

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The article is focused on the production of permanent casting patterns from wood for impermanent moulds by the 5-axis machining centre. Programming of casting pattern was dealt with CAM software by two different manufacturers. Casting pattern, adapted by appropriate allowances, was loaded in the SolidCAM R10 and the CAM Express 7.5 by Siemens. Ergonomics in the working environment of programmes, operation verifications and theoretical machine time were compared. The casting pattern was machined after generating the NC code on FC3800 MACH milling machine. Monitored parameters during computer programming were associated with the measured values when machining casting pattern. Estimated parameters between the computer simulations differed minimally in general, although the programming methods of cutting operations were different. Considerable differences, as expected, were observed in the values of estimated and actual machine time.

Key words: CAM, CNC Milling, Casting Pattern, Software.

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Paper number: M201202

Manuscript of the paper recieved in 2011-11-21. The reviewers of this paper: *Assoc. Prof. Dr. Josef Chladil, MSc. and Prof. Karel Jandecka, MSc., Ph.D.*

Study of Deformation Processes after Hard Turning through Acoustic Emission

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Abstract - The paper deals with analysis of deformation processes and related aspects of the chip formation as the chip thickness, the chip ratio and the shear angle during turning hardened steel 100Cr6. This paper investigates influence of feed on the mentioned aspects through the metallographic analysis, calculation of the significant aspects of deformation processes and the following experimental study. This experimental study is based on application acoustic emission sensors. The results in this study reports that feed significantly does not affect such parameters as the chip ratio, deformation angle in the cutting zone. On the other hand, experimental study indicates that increasing of feed in hard turning causes increasing of the process instability and increasing intensity of deformation processes in the cutting zone.

Keywords: turning, hardened steel, chip segmentation, acoustic emission

Acknowledgment
This project is solved under the financial support of KEGA agency (project n. 031ŽU-04/2011).

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Paper number: M201203

Manuscript of the paper recieved in 2011-11-21. The reviewers of this paper: *Prof. Jan Madl, MSc., Ph.D. and Prof. Dr. h. c. Karol Vasilko, MSc., Sc.D.*

Experimental verification of abrasive mass flow impact on the technological head acceleration amplitude and vibrations frequency in the production system with AWJ technology

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During the operation of manufacturing systems with hydroabrasive jet technology, arising in the production system vibrations, which affeon ct its reliability and durability, operating costs and consequently economic efficiency and operational safety. The emergence and spread of vibrations generated by water jet technology remains actual and theoretically difficult issue, which is currently not sufficiently developed. Despite the best efforts of researchers and a good knowledge of the operation in PS with water jet technology remains unexplained facts. One of them is the abrasive mass flow technological parameter affecting the acceleration amplitude and vibrations frequency on technological head, which is the subject of experimental investigation during cutting steel abrasion resistant HARDOX 500.

Keywords: hydroabrasive water jet, technological head, vibration acceleration amplitude, frequency, cutting of material

Acknowledgement

This work was partially supported by EU Structural Funds, R&D 2.2, Project ITMS 26220220103 "Research and development of intelligent unconventional actuators based on artificial muscles" and by Institutional research task IU 5/2011.

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Paper number: M201204

Manuscript of the paper recieved in 2011-12-18. The reviewers of this paper: *Assoc. Prof. Miroslav Muller, MSc., Ph.D. and Assoc. Prof. Libuse Sykorova, MSc., Ph.D.*

GICS for grinding process optimization

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The article deals with the automation of the grinding machine duty cycle. There are both described, the problems of the automation of the duty cycle and the present state summarised in this paper. The control systems of grinding cycle run from the experiences and process knowledge. Real GICS (Grinding Intelligent Control System) must be founded on the process monitoring and to create own control system with principal parameters of grinding. Cutting speed, workpiece motion speed, depth of cut, volume of coolant, course of cutting forces and other process parameters can form single control components at the adequate process knowledge. At some control systems description the authors assume the future possible direction of development, considering possibilities in the use of the expert and intelligent systems.

Keywords: grinding, grinding wheel, adaptive system, expert system, intelligent system

Acknowledgement

Above mentioned results were created by means of national project GA CR No.101/09/0504.

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Paper number: M201205

Manuscript of the paper recieved in 2011-11-21. The reviewers of this paper: *Prof. Imrich Lukovics, MSc., Ph.D. and Prof. Dr. h. c. Karol Vasilko, MSc., Sc.D.*

Experimental Verification of the Relation between the Surface Roughness and the Type of Used Tool Coating

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This contribution deals with the need of continual experimental study of the phenomenon that relates to the increasing demands to the quality of engineering production and also to the productivity and economy of the production. Experimental part is focused to the influence of the tool coatings, which significantly affect the roughness of the material machined with the use of the cutting plates made of high-speed cutting steel. The plates were used in the series of the experiments, what allows us to create the models of real situations in the area of concrete manufacturing technology and subsequently to analyze them. To the measured and evaluated parameters belonged: the roughness of the machined material after the use of coated and uncoated tools. Planing technology is realized until there are major visible changes in cross roughness of the machined material, what means the increasing of Rz values. This is caused by the fact, that the coating was removed from the cutting edge, what is considered as the blunting of the tool. Measured values are statistically expressed in the form of the graphs.

Keywords: planing, tool coating, roughness, cutting tool, high-speed steel

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Paper number: M201206

Manuscript of the paper recieved in 2012-02-15. The reviewers of this paper: *Prof. h.c. Stanislaw Legutko, MSc, Ph.D. and Prof. Jan Madl, MSc., Ph.D.*

Experimental Verification of FEM Simulation of GMAW Bead on Plate Welding

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The research focuses on verification of FEM simulation of GMAW bead on plate welding with experimental results. In the program Visual Environment simple FEM simulation of GMAW bead on plate welding on Al alloy EN AW 7022 was created and these simulation data were compared with measured experimental data. To create good FEM model setting of heat source and material parameters are of great importance. To set parameters of heat source measurement of welding parameters, metallographic sample, weld bead and end crater was experimentally done. During experiment, temperature was measured by several thermocouples and measured temperature was compared with simulation data. The difference of measured and simulated data was at maximum only 10°C and we can conclude that this result is very good. Simulations that obtain results close to reality are very useful for designing welded constructions. Designing from using precipitation hardenable Al alloys, e.g. series 7xxx, materials prone to softening, when welded, can be thus made easier and safer using simulation software.

Keywords: simulation, thermal field, Visual Environment, GMAW, welding, Al alloy, 7022

Acknowledgement

Research was supported by grants SGS ČVUT 2010 č. OHK 2-038/10 and FRVŠ G1 611/2011.

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Paper number: M201207

Manuscript of the paper recieved in 2011-12-29. The reviewers of this paper: *Assoc. Prof. Ivo Hlavaty, MSc, Ph.D. and Prof. Josef Mesko, MSc., PhD.*

Productivity Investigation within the ERP System

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The paper presents utilization of class ERP system for examination, analysis and updating of production standards. The investigation has been performed in a medium size enterprise manufacturing products of steel strip and sheet. It has been shown that everyday reporting of production in the ERP class system makes it possible to examine the individual products in respect of the production time and becomes a basis of verification of the standards imposed by the master firm. Continuation of the reexamination after verification of standards will most probably initiate introduction of piecework wage system.

Key words: ERP system, productivity

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Paper number: M201208

Manuscript of the paper recieved in 2011-12-18. The reviewers of this paper: *Assoc. Prof. Jaromir Stusek, MSc., Ph.D. and Assoc Prof. Gejza Horvath, MSc., Ph.D.*

Laser Machining of Chosen Materials

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A paper deals with technological applications of laser. It evaluates the influence of design and technological conditions on output parameters of cutting process and also presents relative laser machinability of polymeric and metallic materials; in addition, it shows possible evaluation of structural change of metals and it gives mathematical model for determination laser cutting quality functions based on results of the experimental research. The temperature distribution has been derived. Results of plastic materials and hard-to-machining metals machinability are shown. Finally, surface quality evaluation after exposure to concentrated light energy and quantification of material microhardness are described.

Keywords: laser machining, technological conditions, simulation.

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Paper number: M201209

Manuscript of the paper recieved in 2012-01-11. The reviewers of this paper: *Prof. Jan Madl, MSc., Ph.D. and Prof. Dr. Frantisek Holesovsky, MSc.*

Impact of technical diagnostics interval on machinery maintenance

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Machinery maintenance significantly participates in its reliable, serviceable and safe operation. Well-timed maintenance can identify a fault condition of machinery leading to manufacturing a product of poor quality. Maintenance interval can be fixed or maintenance can be done when needed, meaning at the moment when some of operating parameters get worse. An example of determination of diagnostics interval set based on machinery vibrodiagnostic measurement is described in the paper. The shown steps are universal and can be applied to another technical diagnostics methods as for example tribodiagnostics, thermodiagnostics, non-destructive materiology etc.. This way economic savings can be reached better comparing to maintenance done in fixed planned dates.

Keywords: maintenance, diagnostics interval, vibrodiagnostics.

Acknowledgement

In relation to writing this paper we need to thank our colleagues-diagnosticians above all, for their pro-active approach in implementation of new methods of diagnostics management.

This paper was created with a grant support of project ČZU 31190/1312/3122 (Czech University Of Agriculture in Prague) – "Impact of biofuels and operation parameters on engine smoke"

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Paper number: M201210

Manuscript of the paper recieved in 2011-11-21. The reviewers of this paper: *Prof. Jan Skalla, MSc., Ph.D. and Dr. Milan Dian, MSc.*

Research into the causes cracking of aluminum alloys of Al – Cu during mechanical machining

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The aim of the work was carried out research on the causes cracking formed aluminum work pieces in the assortment of rods, which sometimes occur in the mechanical machining (turning, drilling) for alloys of Al-Cu. A typical representative for the machining of aluminum alloys is AlCu4MgMnPb alloy, most of which performs heat treatment for hardening increases the ultimate strength. For the given alloy were carried out qualitative and quantitative fractographic analysis of fracture surfaces after machining in order to determine possible causes cracking of the material and thus his insufficient strength. This paper clearly documented that the fractographic analysis methods can clearly and in the extent required to provide answers to the causes of insufficient strength of the material when cutting. At the same time points out the possible causes of cracks in this alloy in machining and ways for their elimination.

Keywords: AlCu4MgMnPb alloy, hardening, eutektikum, EDX analyses

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Paper number: M201211

Manuscript of the paper recieved in 2011-12-21. The reviewers of this paper: *Assoc. Prof. Dana Bolibruchova, MSc, PhD. and Prof. Iva Nova, MSc., Ph.D.*

Vibratory superpolishing of a ti alloy aerospace material with thermally treated recycled glass media

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This paper reports on the outcomes of an investigation concerned with the machining performance of thermally treated recycled glass in the vibratory mass finishing process. The surface finish generated with the glass is compared to that achieved using conventional polyester bonded media under different lubrication conditions. To help understand the wear behavior of the glass, measurements of the surface topography were obtained at intervals throughout the tool life, using a replication method. A further series of tests were undertaken to establish self-attrition rates. It has been demonstrated that the machining performance of recycled glass media is comparable to that of conventional media in respect of surface finish (Ra), brightness cycle time, self-attrition rate and tool life. This innovative work provides strong promise for the introduction of this new media into the abrasives marketplace for polishing, superpolishing and superfinishing of engineering materials.

Keywords: Superpolishing, Abrasives, Glass, Recycling, vibratory mass finishing

Acknowledgements

The authors wish to extend their thanks to Mr Eugene Kalt for his support with the surface topography measurements and Mr Peter Moran for his continued technical support.

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Paper number: M201212

Manuscript of the paper recieved in 2012-02-18. The reviewers of this paper: *Assoc. Prof. Pavel Novak, MSc, Ph.D. and Prof. Jan Madl, MSc., Ph.D.*

Abrasive wear effect on Polyethylene, Polyamide 6 and polymeric particle composites

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An agricultural machine construction is exposed to significant effects of functional areas wearing. The application of polymeric materials and composite materials seems to be prospective. The abrasive wear resistance was tested on rotating cylindrical drum device with the abrasive cloth of the grain size P120. Various modifications of polymeric particle composites, Polyethylene and Polyamide 6 were tested. The polymeric particle composites research and production were focused on knowing the dependence among a two-component epoxy adhesive and various concentration and fraction of corundum hardening particles Al_2O_3. Polymeric particle composites showed a potential possibility to resist to high abrasive wear (evaluated decreases in volume) when applying the hardening phase of the grain sizes F80 and F240 and the concentration no exceeding 45%. They showed a low density ρ 1.20 till 2.00 g·cm^{-3} comparing the steel (ρ = 7.75 g·cm^{-3}).

Keywords: polymers, polymer particle composite, resistance, two-body abrasion with impact, wear

Acknowledgement

Supported by Internal grant agency of Faculty of Engineering, Czech University of Life Sciences in Prague

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Paper number: M201213

Manuscript of the paper recieved in 2012-03-19. The reviewers of this paper: *Assoc. Prof. Jitka Podjuklova, MSc, Ph.D. and Assoc Prof. Pavel Novak, MSc., Ph.D.*

Application of Barkhausen Noise for Analysis of Surface Integrity after Hard Turning

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Introduction into problems - This paper deals with the application of Barkhausen noise for investigation of residual stresses after hard turning. The results illustrate the differences in the stress distribution after hard turning and grinding. The analysis of the stress and structure state shows that the conventional evaluation of Barkhausen noise fails and monitoring of surface integrity will require a subsequent modified approach. The main reason for it is a more complicated relationship between stresses, surface hardness and structure. And so the modified approach is described for monitoring surface integrity after hard turning operations. This modification is based on the biaxial stress with the high correlation to the tool wear. The main idea is based on the non proportional increase of stress in the different directions.

Keywords: residual stress, hard turning, Barkhausen noise

Acknowledgment

This project is solved under the financial support of VEGA agency (project n.1/0223/11) and also project TA02011031 (Technological Agency of Czech republic).

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Paper number: M201214

Manuscript of the paper recieved in 2011-11-21. The reviewers of this paper: *Prof. Dr. Bruno Sopko, MSc., Sc.D. and Prof. Nikolaj Ganev, MSc., Ph.D.*

Surfaces with high precision of roughness after grinding

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The traditional approach to grinding is to operate within the limits of surface quality. The requirements for surface quality in grinding are higher than those in other common machining operations such as turning and milling. The surface quality of machined parts is very important for precise production and assembly. When we focus on roughness parameters after grinding, we can establish the limits of these parameters for typical grain materials: Al_2O_3, SiC, CBN, SG and others. Increasing demands on accuracy and quality of production leads to research concerned with the properties of these materials and the surface quality after grinding. This paper shows new possibilities for the ground surface with focus on surface roughness obtained under varying combinations of cutting conditions. The influence of the grinding wheel, cutting parameters and coolant on higher surface quality is assessed by roughness parameters Ra, Rz, Rt and the Material portion of a surface profile. These high-precision ground surfaces are shown to have a Nanometres (10^{-9}) unit topography demonstrating that the process is able to replace other finishing technologies such as superfinishing or honing.

Keywords: Grinding, High precision, Roughness, Surface

Acknowledgement
Above mentioned results were created by means of national project GA CR No. 101/09/0504.

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Paper number: M201215

Manuscript of the paper recieved in 2011-12-28. The reviewers of this paper: *Prof. Dr. h. c. Ioan D. Marinescu, MSc., Ph.D. and Dr. Michael N. Morgan, MSc.*

Increasing of Product Quality Produced by Rapid Prototyping Technology

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In paper are presented basic characteristics and problems in area of Rapid Prototyping technology with use of layered production technology named Fused Deposition Modelling (FDM). It is progressive method of 3D model product creation based on geometry obtained from CAD system with application in different industrial areas. Text of the paper is focused on optimization of Rapid Prototyping preparation process. There also is algorithm that leads to selection of suitable setting conditions. Utilization of algorithm is explained on case of printing with use of UPrint device and Catalyst software. There are outputs in form of graph and tables accumulating information directly affecting economical and quality aspects of Rapid Prototyping production technology.

Key words: Rapid Prototyping, product quality, suitable setting conditions

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Acknowledgement

Ministry of Education, Science, Research and Sport of SR supported this work, contract VEGA 1/0032/12, KEGA No. 002TUKE-4/2012 and ITMS project 26220220125.

Paper number: M201216

Manuscript of the paper recieved in 2011-11-21. The reviewers of this paper: *Assoc. Prof. Dr. Vladimir Pata, MSc., and Prof. Jiri Hruby, MSc., Ph.D.*

Application of Progressive Materials for Rapid Prototyping Technology

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In paper are presented basic information about common and progressive materials used for realization of products by Rapid Prototyping technology application. The initial state of material can come in either solid, liquid or powder state. In solid state it can come in various forms such as pellets, wire or laminates. The current range materials include paper, nylon, wax, resins, metals and ceramics. Last mentioned materials are used manly in application of Rapid Prototyping technology for rapid manufacturing of products or rapid production of tools - Rapid Tooling.

Keywords: Rapid Prototyping, rapid prototyping materials, rapid manufacturing

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Acknowledgements

Ministry of Education, Science, Research and Sport of SR supported this work, contract VEGA 1/0032/12, KEGA No. 002TUKE-4/2012 and ITMS project 26220220125.

Paper number: M201217

Manuscript of the paper recieved in 2011-11-21. The reviewers of this paper: *Assoc. Prof. Dr. Vladimir Pata, MSc. and Prof. h. c. Stanislaw Legutko, MSc., Ph.D.*

Design of a Casting Die in CATIA

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Design of a Casting Die made of aluminium alloy components using *CATIA* software is described in the article. Computer aided design and construction is necessary for the creation of each part. A lot of tools are implemented in the *CATIA* program. These tools are used to design cast parts easily. A few aspects are necessary for this technology- To achieve a quality fine-grained structure without porosity and the oxide inclusions, a possibility to observe the casting, solidification, tempering, easy creation of core and cavity, possibility of rapid design whole mould. This factors influence efficiency of construction, quality of the product and production economy. Use of *CAx* technologies is necessary to meet the requirements [7]. Simulation in some simulating program occurred before this construction. These programs work on basis of Navier- Stokes law and law of conservation of momentum [4]. Combination of these products influences efficiency, productivity and financial expenses.

Keywords: Casting Die, Construction, CAD, CATIA, Computer Aided Design, Pressure Casting

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Paper number: M201218

Manuscript of the paper recieved in 2011-12-18. The reviewers of this paper: *Assoc. Prof. Jaromir Stusek, MSc, Ph.D. and Assoc Prof. Gejza Horvath, MSc., Ph.D.*

Processing engineering of large composites structures using low-pressure vacuum infusion

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Composite materials, such as fibre reinforced plastics and sandwich panels, have considerable potential for use in the next generation of transport structures. They are lightweight, durable, and readily moulded to shape. However, there are also additional complexities associated with the use of composites, particularly in terms of design and manufacture. These complexities, together with issues of cost, are currently limiting their adoption by the transport sectors. The selection of the manufacturing process for a composite component will normally depend upon the nature of part and the required production volumes. We try to present vacuum assisted resin infusion process, suitable for low-medium production volumes (less than 500 parts per year). Vacuum infusion is well suited to large parts (greater than 1m) with intermediate fibre content (less than 35% by volume). As a reference product was selected overhead - side panel of train cabin designed like a sandwich construction with suitable foam or honeycomb core. Our experimental results described vacuum infusion process like actual variant to produce designed products to transport industry.

Keywords: vacuum infusion, matrix, sandwich construction.

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Paper number: M201219

Manuscript of the paper recieved in 2011-12-18. The reviewers of this paper: *Assoc. Prof. Dana Bolibruchova, MSc, PhD. and Prof.Iva Nova, MSc., Ph.D.*

Two local extremes of cutting speed

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In 1906 Taylor mathematically defined the dependance of tool durability on cutting speed in the form: $T = \frac{C_T}{v^m}$ **for the first time. It is an equation of a hyperbola, which represents itself as a straight line in double logarithmic net according to Taylor. The dependance is valid for the tools made of high-speed steel. It has still been used in spite of the fact that new cutting materials, which cannot be used according to it, or can be used only partially in a narrow range of higher cutting speeds. The course of function T=f(v_c) for the tools made of sintered carbid and ceramics will be identified in the paper. It requires extensive durability tests in a wide range of cutting speed. Interesting conclusions can be derived from its course.**

Keywords: surface roughness, cutting force, tool life

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Paper number: M201220

Manuscript of the paper recieved in 2011-11-04. The reviewers of this paper: *Prof. Karel Kocman, MSc., Sc.D. and Prof. Dr. Frantisek Holesovsky, MSc.*