TALLINNA TEHNIKAÜLIKOOL

MASINAEHITUSE INSTITUUT
Department of Machinery

TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE

2013

TALLINN
2014

1. INSTITUUDI STRUKTUUR

Instituudi direktor dots. Kristo Karjust

- Autotehnika õppetool, Chair of Automotive Engineering, prof. Jüri Lavrentjev
- Tootmissüsteemide õppetool, Chair of Manufacturing Systems, prof. Jüri Riives
- Tootearenduse õppetool, Chair of Product Development, prof. Martin Eerme
- Tootmistehnika õppetool, Chair of Production Engineering, prof. Tauno Otto
- Disaini õppetool, Chair of Design, prof. Martin Pärn

Tabel 1 – ME Instituudi töötajad 31.12.2013 seisuga

Jrk	Perekonnanimi	Eesnimi	nimetus	Hõive	**Õppetool**
1	**Auriemma**	Fabio	teadur	1	Autotehnika õppetool
2	**Eerme**	Martin	professor	1	Tootearenduse õppetool
3	**Hermaste**	Aigar	lektor	1	Tootmistehnika õppetool
4	**Herranen**	Henrik	nooremteadur	1	Tootearenduse õppetool
5	**Karaulova**	Tatjana	teadur	1	Tootmistehnika õppetool
6	**Karjust**	Kristo	dotsent, direktor	1	Tootmistehnika õppetool
7	**Kirs**	Maarjus	nooremteadur	0,5	Tootearenduse õppetool
8	**Kulbas**	Ruth	sekretär	1	Tehniline töötaja
9	**Kõiv**	Risto	lektor	0,5	Autotehnika õppetool
10	**Lavrentjev**	Jüri	professor	1	Autotehnika õppetool
11	**Lend**	Henri	nooremteadur	0,5	Tootearenduse õppetool
12	**Luppin**	Janek	lektor	0,75	Autotehnika õppetool
13	**Majak**	Jüri	vanemteadur	1	Tootmistehnika õppetool
14	**Melioranski**	Ruth-Helene	teadur	0,25	Disaini õppetool
15	**Napp**	Andres	tehnik	1	Tehniline töötaja
16	**Nõmme**	Siim	insener	0,5	Autotehnika õppetool
17	**Otto**	Tauno	professor	1	Tootmistehnika õppetool
18	**Paavel**	Marko	insener	0,5	Tootmistehnika õppetool
19	**Pohlak**	Meelis	vanemteadur	1	Tootearenduse õppetool
20	**Päev**	Erkki	insener	0,5	Tootmistehnika õppetool
21	**Pärn**	Martin	külalisprofessor	0,5	Disaini õppetool
22	**Pääsuke**	Kaarel	assistent	0,25	Tootmistehnika õppetool
23	**Randmaa**	Merili	assistent	0,5	Tootmissüsteemide õppetool
24	**Riives**	Jüri	professor	0,5	Tootmissüsteemide õppetool
25	**Rämmal**	Hans	vanemteadur	1	Autotehnika õppetool
26	**Sarkans**	Martinš	haridustehnoloog	0,5	Tehniline töötaja
27	**Semeniuk**	Mykola	insener	1	Tehniline töötaja
28	**Sonk**	Kaimo	lektor	0,75	Tootearenduse õppetool
29	**Ševtšenko**	Eduard	vamemteadur	0,5	Tootmistehnika õppetool

30	**Tähemaa**	Toivo	dotsent	0,75	Tootearenduse õppetool
31	**Veldi**	Ilje	asjaajaja	0,5	Tehniline töötaja
32	**Vene**	Karl-Kristo	insener	0,5	Tehniline töötaja

Tootearenduse-, tootmistehnika- ja tootmissüsteemide õppetoolide juurde kuuluvad järgmised laborid:

1. Prototüüpide kiirvalmistamise labor
2. Toodete modelleerimise ja materjalide dünaamilise- ning vibrokatsetuste labor
3. Tootmise automatiseerimise labor
4. Hüdro- ja pneumoseadmete labor

Olulisemad seadmed:
Kiirprototüüpimise masinad - Zprinter 310 ja Formiga P 100.
Optilised skännerid GOM ATOS, GOM TRITOP, GOM ARAMIS ja GOM ARGUS.
Robotsüsteem ABB (180 kg, 2,55 m)
Vibrostend (Shaker system) TIRA TV 5220-120

Olulisemad tarkvarad:
ANSYS Professional V12.1. Ansys on LEM programmipakett, mis võimaldab sooritada erinevaid toodete simulatsioone (tugevusarvutus, voolamise ülesanded jne). On olemas programmi kommerts- litsents tööstusprojektide tegemiseks. Varem kasutati programmi vaid õppetöös.

Autotehnika õppetooli laborid:

1. Sisepõlemismootorite labor
2. Akustikalabor

Mootorilabori kõige kaasaaegsemateks seadmeteks on:

- väljaheitegaaside 4-komponendiline analüsaator (Bosch),
- endoskoop (Karl Storz),
- 2-kanaline digitaaltermomeeter,
- 8-kanaliline analoog-digitaal andmeloger (NI)
- mootorite tehnilise diagnostika seade Automotive Kit.

Akustikalabori olulisemateks seadmeteks on:

- dünaamiline kuumade gaaside mõõtestend (kiirus kuni 100 m/s, temperatuur kuni 200 C)
- 2-kanaliline pieso-elektriline mõõteseade koos vedelikjahutusega dünaamiliste rõhuanduritega (Kistler),
- 4-kanaliline D/A andmeloger (National Instruments) kiirete protsesside mõõtmiseks arvuti abil,
- 4 mõõtemikrofoni koos eelvõimenditega (PCB).

Instituudi liikmed osalevad aktiivselt Innovatiivsete Masinaehituslike Tootmissüsteemide Tehnoloogia Arenduskeskuse (IMECC) töödes.

2. INSTITUUDI TEADUS- JA ARENDUSTEGEVUSE ISELOOMUSTUS

Masinaehituse instituudi põhilised teadussuunad 2013 aastal:

- Komposiit- ja funktsionaalsetest materjalidest konstruktsioonide, toodete ja tootmisprotsesside optimaalne projekteerimine (Vanemteadur Jüri Majak)
- Mehhatroonika- ja tootmissüsteemide proaktiivsus ja käitumismudelid (Prof. Tauno Otto)
- E-tootmise kontseptsioon väike- ja keskmise suurusega ettevõtetele (Prof. Tauno Otto)
- Materjalide ja konstruktsioonide optimeerimine arvestades elastset ja/või plastset anisotroopiat (Vanemteadur Jüri Majak)
- Digitaalsete otsetootmisprotsesside analüüs ja arendus (Vanemteadur Meelis Pohlak)
- Tootmisettevõtete jätkusuutlikkuse parendamine töökindla tehnoloogia abil (Teadur Eduard Ševtšenko)
- Kõrgtemperatuursete gaaside voolu akustika eksperimentaalsed uurimismeetodid (Prof. Jüri Lavrentjev).

2.1 Struktuuriüksuse koosseisu kuuluvate uurimisgruppide kirjeldus ja tulemused

2.1.1 Teadustöö kirjeldus (inglise keeles)

a) The e-manufacturing and production systems proactivity concept for small and medium-sized enterprises (T213B, ETF7852).

Persons: Prof. Tauno Otto, Prof. Jüri Riives, researcher Eduard Ševtšenko, lector Aigar Hermaste, assistant Kaarel Pääsuke, lektor Kaimo Sonk, assistant Merili Randmaa, Martins Šarkans

The e-Manufacturing research group is focused on elaboration of concept for SME. Small and medium sized enterprises where orders (and their nature) changes, technological processes might vary in relatively great extent, need flexible and easily adoptable integrated systems, reaching over the single enterprise and covering whole cluster if needed. In scientific matter use of embedded systems (smart dust) enables to link enterprise information systems in a new way. Web-enabled and information technologies play indispensable roles in supporting and enabling the complex practices of design and manufacturing by providing the mechanisms to facilitate and manage the integrated systems. Proactive solutions are major pillars that support the success of the integration of e-Manufacturing and e-business. Machinery enterprises in Estonia are mainly SME. There are over 400 small and medium sized enterprises in the machinery apparatus and metal engineering sector. Estonia is a good testing and implementation region such models as here is needed www infrastructure, Internet using habits and interest toward novel e-solutions. Integrating order handling system and ubiquitous computing gathering manufacturing data through “smart dust” (motes) network and analysing it by data mining tools is possible discover alerting situation by

decision support system and enable enhanced productivity through in-time order handling and resource sharing network implementation.

This is connected to a interdisciplinary research of mechatronics and production systems proactivity and behavioural models. Activity of the research group is concentrated on proactive decision support in networked collaborating enterprises of special tooling and machining. Intelligent prediction of manufacturing capability in enterprises cluster for preventing management failures thus following the Predict and Prevent Bottleneck manufacturing paradigm enables achieving of near-zero down-time and the best possible quality of product in comparison with the currently prevalent Fail and Fix paradigm mirrored in reactively addressing and fixing the manufacturing problem once it occurs.

b) Optimal design of composite and functional material structures, products and manufacturing processes (T035)

Persons: senior researcher Jüri Majak, senior researcher Meelis Pohlak, professor Martin Eerme, professor Jüri Lavrentjev, seenior researcher Hans Rämmal, researcher Tatjana Karaulova, associate professor Kristo Karjust, associate professor Toivo Tähemaa, junior researcher Henrik Herranen, junior researcher Henri Lend.

The present application focuses on scientific/engineering aspects of manufacturing engineering including the development of novel methods and tools for optimal product development and manufacturing planning in industry. The goal of the research project is to develop methods and techniques for optimal design of products and manufacturing processes. Main sub-goals can be outlined as: 1. Optimal design of composite and functional material structures, products and manufacturing processes, 2. Exploiting advanced materials and structures in design, 3. Development of sustainable manufacturing technologies. The objectives of the current research project draw on needs of European and Estonian technology platforms for manufacturing industry and are formulated in accordance of the General roadmap of EU programme FACTORIES OF THE FUTURE - BEYOND 2013

c) Smart Composites – Design and Manufacturing (AR12139)

Persons: senior researcher Jüri Majak, senior researcher Meelis Pohlak, professor Martin Eerme, professor Jüri Lavrentjev, professor Rein Küttner, Professor Tauno Otto, researcher Heiki Tiikoja, associate professor Kristo Karjust, associate professor Toivo Tähemaa, junior researcher Henrik Herranen, junior researcher Henri Lend, engineer Maarjus Kirs, persons from different institutions like: Department of Materials Engineering, Institute of Cybernetics, Laboratory of Proactive Technologies at Department of Computer Control, Thomas Johann Seebeck Institute of Electronics, Small Craft Competence Centre, OÜ Eliko Tehnoloogia Arenduskeskus, Defendec OÜ, Goliath Wind OÜ, Kasse Paadid OÜ, Lindvart OÜ, Luksusjaht AS, MMG Taastusravi OÜ.

The general goal of the project is to develop smart composite materials and structures according to the needs of Estonian industry TOPICS: Design of smart composite materials and structures

Development of computational modeling capabilities and manufacturing techniques for the design of smart materials and structures Validation and evaluation of the smart composites.

d) EmerEEG - A portable device for Early detection and treatment of Traumatic Brain Injury based on advanced qEEG and HD-TES to prevent major Health problems and specially for use in emergencies and telemedicine (FP7-SME-2013-605103)

Persons: associate professor Kristo Karjust, senior researcher Jüri Majak, senior researcher Meelis Pohlak, junior researcher Henrik Herranen, junior researcher Henri Lend, engineer Maarjus Kirs.

Traumatic Brain Injury (TBI) is recognized as a major public health concern, especially for teenagers and young adults, since it can lead to significant disruption in education, working ability, and quality-of-life in general. It is one of the leading causes of death and disability worldwide. 1.2 million EU citizens are hospitalized with TBI each year and of which 50.000 die. The total economic burden in Europe for TBI of all known severities is estimated EUR 33 billion annually. Currently, there is no objective method for diagnosing TBI in an early stage or in emergency, which is a premise to prevent serious health impact. Our idea is to develop a portable medical device for objective and reliable emergency diagnosis of TBI and a monitored personalized treatment based on qEEG (quantitative electroencephalography) and HD-TES (High-Definition Transcranial Electric Stimulation).

We propose to create innovative technology for the early detection and treatment of one of the most severe cognitive diseases for the use in emergency, telemedicine, hospitals, and rehabilitation centers. We will achieve this by 1) developing a novel vacuum based helmet device that will enable an accurate positioning system of up to 32 electrodes, 2) developing an instrumentation system that will combine qEEG recording and HD -TES treatment, 3) developing a data processing system that will control all measurements and data analysis including the algorithm for early detection and treatment of TBI.

e) Design of Materials and Structures with elastic and/or plastic anisotropy (ETF 8485)

Persons: senior researcher Jüri Majak, senior researcher Meelis Pohlak, professor Martin Eerme, associate professor Kristo Karjust, junior researcher Henrik Herranen, junior researcher Henri Lend.

Project contains two main research areas:

1. Optimal design of composite structures
2. Structural analysis and design of sheet metal forming processes

Development of the multistage optimisation strategy combining FEA, function approximation and global optimisation algorithms is planned in order to solve engineering design problems considered. Treatment of discretization methods for particular problem cases has been foreseen.

f) Enhancing Sustainability of Manufacturing Enterprises through reliability engineering (ETF9460)

Persons: researcher Eduard Ševtšenko, researcher Tatjana Karaulova.

The purpose of this grant is to redesign the manufacturing processes in reliable way. The focus is to increase the internal effectiveness of production processes. Objectivities of the work have 3 main directions, because they are connected with doctoral theses (during this grant implementation must be done 3 doctoral works). Its main directions are: 1. Intelligent module elaboration for optimal allocation of resources and elimination of the production processes faults. 2. Reducing waste by changing the patterns of production, using Green initiatives. 3. Development the maintenance plan: maintenance activities on operational level. Optimization quality inspection process Hypothesis 1. Sustainability can make businesses more profitable. 2. The integration of technological processes with reliability analysis enables to increase the production process efficiency. 3. The planning and scheduling of preventive maintenance activities is often crucial for the cost-effectiveness of many large industrial organizations. 4. Production waste realisation gives economic and ecological effect. Significance of the project for science and national economy • The new world of sustainable technologies and work practices is undoubtedly a challenging and exciting emerging reality for the manufacturing industries. Manufacturers of all sizes are turning to lean manufacturing techniques to reduce waste and save money. As a result of the project implementation, enterprises receive a set of recommendations that, when implemented, result in production efficiencies, environmental improvements, and cost savings. • Green manufacturing, a process for production that bolsters sustainable consumption and production by minimising waste and pollution, has become an increasingly important corporate strategy in the global business arena. Green manufacturing, despite higher incurred costs, offers a distinct competitive advantage over the laggards • Supports and diversifies masters/doctoral studies of researchers. • Links university and industry to develop patents and implement innovations.

g) Analysis and Development of Additive Manufacturing Processes (ETF 9460)

Persons: senior researcher Meelis Pohlak, senior researcher Jüri Majak, associate professor Kristo Karjust, assistent Kaarel Pääsuke, researcher Heiki Tiikoja, lektor Kaimo Sonk, junior researcher Henri Lend.

The objective of the current research project is to analyze the processes involved in Additive Manufacturing (AM) technologies and find ways to improve them. It is planned to study methods and procedures to improve AM processes, especially those that are based on SLS approach. The main tasks of the study are: to develop new simulation models of SLS process by implementing more accurate material models and simulation procedures; to improve accuracy of SLS; to improve SLS process by developing method to apply composite particles/fibers into model in controlled way so that parts with FGM could be produced and to develop multidisciplinary topology optimization procedures for parts made with AM. For achieving the objectives, it is planned to use extensively numerical modeling methods (e.g. FEA) and experimental procedures. Flexibility is an important property of manufacturing processes. One feature of traditional mass production technologies is complicated and time consuming readjustment for production of new products. The capability of fast adaptation to new products assures significant competitive advantage. The technologies

providing such capabilitiy are Additive Manufacturing technologies, also known as Direct Digital Manufacturing or Rapid Manufacturing. In case of these technologies, parts are manufactured directly from three dimensional digital models without significant manual work. The parts are built automatically in layer wise manner by adding material, not removing like in most traditional processes. As the process is additive, it complies with modern environment friendly mentality. No special tooling is required – the process is very flexible and highly automated. One of the most promising AM technologies is Selective Laser Sintering (SLS). In this process, objects are made of powder material by fusing particles together layer by layer with a laser. Parts can be made of metals, polymers, ceramics and composites. Although AM technologies are in industrial use already for several decades, there exist some serious limitations that prevent wider industrial implementation. The main limitations are associated with quality (mechanical properties, surface quality, accuracy of geometry, etc.) of parts produced by AM; only limited number of materials can be used; the productivity is low and the technology is expensive. The wider use of AM technologies depends on removing such limitations, and the current research project addresses this issue.

2.1.2 Aruandeaastal saadud tähtsamad teadustulemused

a) e-Manufacturing Concept for SME (T213B, ETF7852)

Teadustöö keskendus paindtootmis- ja robootikarakendustele ning süsteemi töökindluse prognoosimisele e-tootmises. Doktoritööd kaitsesid Marina Kostina ja Martinš Sarkans.

2013 on analüüsitud tehnoloogiliste ja inimressursside koostoimes tekkiva tehnoloogilise võimekuse ja lean-juhtimise põhimõtteid eesmärgiga kujundada kõrge suutlikkusega e-töökohta. Uuringute oluline eesmärk oli analüüsida reaalaja tootmise seiresüsteeme ja pakkuda paremaid lahendusi.

Seiresüsteemist valmis prototüüplahendus, mis väljatöötatud mudelite jaoks kogus tööpinkidelt ja paindtootmissüsteemi komponentidelt andmeid, analüüsis ja võimaldas reaalajas prognoose sündmuste kohta, mis toimuvad tsehhis. Need andmed aitavad meeskonnal reageerida õigeaegselt toimuvale olukorrale. Demonstraatorina realiseeritud füüsiline mudel võimaldab prognoosida võimalike probleemide teket tootmissüsteemides. Demonstraator lahendus valmis Defendec ja National Instruments komponentidest.

b) Optimal design of composite and functional material structures, products and manufacturing processes (T035)

Applicability of different nonlocal elasticity models for vibration, bending and buckling analysis and design of graphene and nano structures is studied. The elastic anisotropy, geometrical nonlinearity and shear stresses are included models proposed. New research topics are related with taking account surface stress effect.

Analysis and design of smart composite structures i.e. structures with embedded electronics has been continued. ALT technology was adopted for design of defensive housings forelctronic components. Optimal shape and dimensions of the housings are determined by applying muticriteria optimization techniques and response modeling. Experimental study has been performed in order to provide input data for response modeling.

Haar wavelet based discretization techniques are developed/adopted for analysis of nanostructures and functionally graded materials. Special attention is paid to 2D wavelets. An accuracy of the proposed discretization methods has been estimated.

The methodology for design of production monitoring system for SME has been proposed and implemented in private company JELD-WEN Eesti AS.

Publication: Four 1.1 category papers were sent to publishes, 3 of them have currently status accepeted, 4-th is in stage of reviewing. One 1.2 category paper and five conference thesis are published.

c) Smart composites: design and manufacturing (AR12139)

Electronics design:

Development and implementation of acustic emission measuring system using TMS320F28335-DSP. Testing different acceleration measuring equipment based on MSP430. Development of sensornode equiped with acceleration, temperature and tenso sensor

Smart composite design:

The impact of the embedded system on stiffness/strength properties of the smart composite has been studied experimentally and numerically. The FE model developed was used for optimal design of the shape and dimensions of the housing of electronic component.

Analysis and design of the laminate structures used in small wind turbine blades has been performed. Some concepts for design of sandwich structures has been proposed. Special attention has been paid to minimising stress concentration in interfaces between layers. Taking use of functionally graded materials in sandwich structures was considered as one possible solution for providing more uniform stress distribution over structure.

Initial structural health monitoring tests have been performed in private company „Goliath“ (project partner).

The results are published in two 1.1 category papers (currently accepted status) and three conference thesis.

d) Design of Materials and Structures with elastic and/or plastic anisotropy (ETF 8485)

Main aims of the project and also planned publication was achieced already to the end of 2012 year. Thus, in 2013 here was posibility to extend reseach topics including bending and vibration of nanostructures. Main attention was paid to taking account small scale effect. Different non-local elasticity approach are considered (Eringen, strain gradient based model

hybrid model, atomic model). The study if focused to geometrically nonlinear structures, analysis and optimal design of multilayer nanoplates, graphene sheets. Nanostructures are commonly used in design of micro and macrolevel structures especially composite structures.
The existing theory for analysis and design of sandwich structures on macrolovel is adopted for use in nanolevel (nano sandwich).
Study concerning macrolevel composites has been continued in area of functionally graded materials. Special attention is paid to design of functionally graded sandwich structures).
The results obtaind in new research area are published in three conference proceedings.

e) Enhancing Sustainability of Manufacturing Enterprises through reliability engineering (ETF 9460)

The purpose of grant is to redesign the manufacturing processes in reliable way. The focus is to increase the internal effectiveness of production processes. Intelligent module elaboration for optimal allocation of resources and elimination of the production processes faults. (Developed the framework for six sigma level measurement in manufacturing enterprises, which is presented at scientific conferences.) Reducing waste by changing the patterns of production, using Green initiatives. (Based on this topic PhD thesis "Green Manufacturing" projects development and integration to machinery indastry of Viktoria Bashkite is defended.)

Publications in period:

1.1

-Maleki, M.; Shevtshenko, E.; Cruz-Machado, V (2013). Comparative Analysis of Customer Value Dimensions. Inzinerine Ekonomika-Engineering Economics, 24(5), 488 - 495.

1.2

-Maleki, M.; Shevtshenko, E.; Cruz-Machado, V. (2013). Development of Supply Chain Integration model through application of Analytic Network Process and Bayesian Network. International Journal of Integrated Supply Management, 8, 67 - 89.

3.1

-Sahno, J.; Sevtsenko, E.; Karaulova, T. (2013). Knowledge Management Framework for Six Sigma Performance Level Assessment. Advances in Information Systems and Technologies (255 - 267). Portugal: Springer-Verlag Heidelberg

-Bashkite, V.; Karaulova, T.; Starodubtseva, O. (2013). Framework for innovation-oriented product end-of-life strategies development. In: Procedia Engineering: 24th DAAAM International Symposium on Intelligent Manufacturing and Automation, 2013. (Toim.) Katalinic, B.. Elsevier, 2013.

3.2

-Polyantchikov, I.; Karaulova, T.; Shevtshenko, E.; Kangilaski, T.; Netribiitshuk, V. (2013). Web-Environment Elaboration for Working with ISO 9001 Documents at a Production Enterprise. Zakis,J.

(Toim.). 13th International Symposium "Topical problems in the field of electrical and power engineering. Doctoral school of energy and geotechnology II" (304 - 311).
-Kangilaski, T.; Polyantchikov, I.; Shevtshenko, E. (2013). Partner Network and its Process Management. In: Proceedings of 10th International Conference on Informatics in Control, Automation and Robotics, ICINCO 2013: 10th International Conference on Informatics in Control, Automation and Robotics, ICINCO 2013, Iceland, Reykyavik, 29-31 July, 2013. (Toim.) J.-L. Ferrier, O. Gusikhin, K. Madani and J. Sasiadek. Portugal: SCITEPRESS - Science and Technology Publications, 2013, 519 - 527.

Defended master thesis:
• Vsevolod Vernikov , Master's Degree, 2013, Optimisation of Manufacturing Business Processes
• Sukrane Ece Esirgen , magistrikraad, 2013, (juh) Eduard Ševtšenko, Theory of Constraints-Drum Buffer Rope Scheduling
• Aleksei Švarts , Master's Degree, 2013, Business Processes Optimization at APL Production AS
• Vitali Netribiitšuk, Master's Degree, 2013, Manufacturing process efficiency improvement in Densel Baltic LLC
• Mihhail Grištšenko , Master's Degree, 2013, Benzoflex Production Batch-to-Batch Variation Reduction at Eastman Specialties OÜ Using Six Sigma Methodology Tools
• Dmitri Durmanenko , Master's Degree, 2013, Toyota Express Maintenance Service process analysis and improvement
• Ilja Plotnikov , Master's Degree, 2013, AS Multipakend production process enlargement
• Kristina Ševtsova , Master's Degree, 2013, Implementation of reliability analysis in Metalliset Group AS
• Olesja Starodubtseva , Master's Degree, 2013, Analysis of metal products manufacturing equipment repair and maintenance.

Defended phD thesis:
Viktoria Baškite, PhD Student, (sup) Tatjana Karaulova, "Green Manufacturing" projects development and integration to machinery indastry, Tallinn University of Technology , Faculty of Mechanical Engineering, Department of Machinery

Finalized Mektori project:
• Lep 13052. Ericsson Production line concept, Mektory project. The analysis of Ericsson company production and replenishment processes was completed followed by productivity imporovements suggestions.
The project task was to"Complete the 1st stage of the radio unit final assembly line concept and its replenishment system. The results of the 1st stage of the engagement:

1. Production line in IDEF0 method (e.g. All Fusion) related to the radio unit final assembly line
2. Characterizing of the AS-IS solution of the radio unit final assembly line in Arena and Enterprise Dynamics.
3. Characterised TO-BE approaches/solutions

f) Analysis and Development of Additive Manufacturing Processes (ETF 9441)

Laserpaagutus on kompleksne multidistsiplinaarne protsess, mille modelleerimine töögrupile kättesaadavate tarkvarasüsteemidega on komplitseeritud, seda eeskätt sobivate materjalimudelite puudumisel. Alustati protsessi modelleerimist, peamiseks keerukuseks on osutunud sobiva materjalimudeli leidmine/väljatöötamine. Laserpaagutusprotsessi täpsuse parandamiseks on läbi viidud uurimistöö erinevate täpsuse vähenemise põhjuste osas. Teostatud on eksperimentaalne uurimistöö lähtudes eelnevalt koostatud katseplaanist. Järgnevalt on tarvis tulemusi analüüsida ja välja töötada meetmed täpsuse parandamiseks. Gradientmaterjali ehk Functionally Graded Material (FGM) rakendamiseks on uuritud erinevaid meetodeid, sh olemasolevaid kiudude kontrollitud laotamise süsteeme ning materjale, mida saaks antud protsessides kasutada. Tulemuste kasutamisel on oluline FGM-materjali mõju toote mehaanilistele omadustele, mistõttu on uuritud ka seda aspekti. Esialgsed tulemused on avaldatud konverentsi ettekannetes (1. Pohlak, M.; Majak, J.; Karjust, K.; Herranen, H.; Lend, H. Design of functionally graded sandwich panels. In: Book of Abstracts: 17-th Internation Conference on Composite Materials, 2013; 2. Majak, J.; Pohlak, M.; Eerme, M.; Kers, J. Nanoscale vibration analysis of graphene sheets using nonlocal elasticity theory. In: Proceedings of the International conference on Mechanics of nano, micro and macro composite structures: Mechanics of nano, micro and macro composite structures, Torino, 18-20 June 2012.). Antud projekti käigus uuritav multidistsiplinaarne topoloogia optimeerimine võimaldaks kasutada digitaalse otsetootmise võimalusi maksimaalselt, seega selle kasutuselevõtust on oodata suurt tulu. Sellest tulenevalt on uuritud kombineeritud, st topoloogia ja ka parameetrilise optimeerimise kasutamise võimalusi.

2.1.3 Uurimisgrupi kuni 5 olulisemat publikatsiooni 2013 aastal

- Maleki, M.; Shevtshenko, E.; Cruz-Machado, V (2013). Comparative Analysis of Customer Value Dimensions. Inzinerine Ekonomika-Engineering Economics, 24(5), 488 - 495.
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2.2 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest

2.3 Loetelu struktuuriüksuse töötajatest, kes on välisakadeemiate või muude oluliste T&A-ga seotud välisorganisatsioonide liikmed.

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