MEHAANIKATEADUSKOND
MEHHATROONIKAINSTITUUT
TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2014

1. Struktuur

Mehhatroonikainstituut, Department of Mechatronics
Instituudi direktor Mart Tamre

- Kvaliteeditehnika ja metroloogia õppetool, Chair of Quality Engineering and Metrology, prof. Toomas Kübarsepp
- Mehhanosüsteemide komponentide õppetool, Chair of Mechanosystem Components, prof. Trieu Minh Vu
- Mehhatroonikasüsteemide õppetool, Chair of Mechatronics Systems, prof. MartTamre
- Mehhatroonika-, mehhano- ja mõõtesüsteemide teadus- ja katselaboratoorium, Laboratory for Mechatronics, Mechano and Measurement Systems, ass. Leo Teder

2. Teadus- ja arendustegevuse (edaspidi T&A) iseloomustus

2.1 Struktuuriüksusesse kuuluvad uurimisgrupid
Uurimisgrupid

Metroloogia ja kvaliteeditehnika
Metrology and Quality Engineering
Prof. Toomas Kübarsepp

The research group active in the metrology field involves three researchers (PhD) and two PhD students. Main research is connected with the investigations and developments in three directions of fundamentals of measurements: electrical conductivity, measurements of geometric and optical quantities. These three directions are tightly connected from the point of measurements and measurement technique and one of the goals is focusing on the theoretical basis of the coherency of those fields. Improved measurement methods (electrical conductivity measurements with planar coils) and unique design high-level measurement equipment (photodetectors for precise measurements of low photon flows – single to some thousand photons). The research group was financed from the TUT R&D project „Metrology in today's sciences". There is an active collaboration with other EU universities and research institutions (PTB, MIKES, EURAMET, etc.). A good example of this kind of collaboration is work at the EU Metrology programme EMRP project NEWSTAR - New Primary Standards and Traceability for Radiometry (EURAMET JRP SIB57 project)
In parallel an intensive work at worldwide Quality Engineering organizations management and administration level has been carried through where an integral part is Estonian quality engineering training and knowledge dissemination.

Olulisemad publikatsioonid:

1. Vaigu, A; Kübarsepp, T; Manoocheri, F; Merimaa, Mikko; Ikonen, Erkki (2014). Compact two-element transmission trap detector for 1550 nm wavelength. Measurement Science and Technology
2. Rastello, M. L. et al (2014). Metrology for industrial quantum communications: the MIQC project. Metrologia, S267 - S275.
3. Dhoska, K; Vabson, V; Hermaste, A; Kübarsepp, T. (2014). Dimensional Accuracy for Multi-element Photodetector. Proceedings of NEWRAD 2014, The 12th International Conference on New Developments and Applications in Optical Radiometry, Espoo, Finland, 24-27 June 2014, 352
4. Kübarsepp, T; A. Pokatilov, A; Vabson, V; Dhoska, K; Porrovecchio, G; Götzinger, S; Manninen, A; Kück, S. (2014). High-attenuation tunnel-type detector for calibration of single-photon devices. Proceedings of NEWRAD 2014, The 12th International Conference on New Developments and Applications in Optical Radiometry, Espoo, Finland, 24-27 June 2014, 115 - 116.
5. Dhoska, K.; Kübarsepp, T.; Hermaste, A. (2014). Uncertainty evaluation of angle measurements by using 3d coordinate measuring machine. Proceedings of 9th International Conference of DAAAM Baltic Industrial Engineering, 24-26th April 2014, Tallinn, Estonia, 221 - 225.

Mehhanosüsteemide modelleerimine
Mechanosystem modeling
Prof. Trieu Minh Vu

The focus in the research is on multibody system dynamics, vibration analysis and monitoring targeted on modelling, and optimization of systems and materials behavioral characteristics and essentially the research is focused on the performance of teleoperated robots, which depends on the remote human awareness and the remote robot manipulation ability. In real operations, the operator performance is also degraded because of the robotic manipulation failures or instability. In this case, the development of intelligent sensors and actuators are important to enhance the remote awareness for the operators. The new systems help to interpret the sensing data, to improve the judgments about the remote environments.
Innovative technologies have been investigated to enhance autonomous and/or hybrid car technology and improve the potential of this technology applicability in everyday life. The new technology focus is in improving autonomous driving and especially complicated maneuvering capabilities of future cars and in optimization of hybrid drive assemblies and their components to reduce energy consumption. The technology is combined with multimodal interfaces to provide multiple sensory channels and enhance the controller and operator performance symbiosis.

Olulisemad publikatsioonid:

1. Trieu Minh, Vu (2014). Feasible Path Planning for Autonomous Vehicles. Mathematical Problems in Engineering, 2014, 1 - 20.

2. Trieu Minh, Vu (2014). Computational Intelligence for Decision Support in Cyber-Physical Systems Studies in Computational Intelligence - Trajectory Generation for Autonomous Mobile Robots . Studies in Computational Intelligence (195 - 214).Springer-Verlag
3. Vu, Trieu Minh (2014). Trajectory Generation for Autonomous Vehicles. T. Březina, R. Jabloński (Toim.). Mechatronics 2013: Recent Technological and Scientific Advances (615 - 626).Springer
4. Vu, Triu Minh (2014). Predictive control for controlling and driving autonomous vehicles. In: Proceedings of the 9th International Conference of DAAAM Baltic, INDUSTRIAL ENGINEERING: 9th International Conference DAAAM Baltic, INDUSTRIAL ENGINEERING, Tallinn, Estonia, 24-26 April 2014. Tallinn: Tallinn University of Technology, 311 - 316.
5. D. Gornostajev, G. Aryassov, S. Zhigailov (2014). Development of the Calculation Method of Plates for Optimization of Hull Thickness . Solid State Phenomena, 256 - 261. [ilmumas]

Mehhatroonikasüsteemid
Mechatronics Systems
Prof. Mart Tamre

The research is focused on proactive smart machine and robotic industrial systems for production and service automation. Activity is concentrated on proactive industrial hardware systems and on smart control capable to work in networked systems. Proactive system behavior have been investigated on the example of the whole production and logistic chain of forestry production where the energy consumption in wide sense and environment impact is used as driving parameters in a technology process. Much attention have been on developing high efficiency new waste sorting technologies for paper and plastic wastes. New high effective sorting methods have been proposed. Different logistics and transportation stages in whole production chain were also investigated to introduce new smart monitoring technologies utilizing today's mobile and sustainability technologies. In parallel to abovementioned reconfigurable robot control and smart algorithms have been investigated and new solutions proposed both for industrial applications (especially human-machine high efficiency interaction and control) and for unmanned autonomous control of vehicular systems for open air terrain and indoor industrial applications, incl. multy-robot collaboration (UGV and UAV case) where the control optimization and mission planning from the safety critical and energy consumption viewpoint is of interest.

Olulisemad publikatsioonid:

1. Lees, Ü.; Hudjakov, R.; Tamre, M. (2014). Development of virtual reality interface for remote robot control. In: Proceedings of the 9th International DAAAM Baltic Conference "INDUSTRIAL ENGINEERING", 24-26th April 2014, Tallinn, ESTONIA: 9th International DAAAM Baltic Conference "Industrial Engineering", Tallinn, Estonia, 24-26. April 2014. Tallinn: Tallinn University of Technology, 247 - 250.
2. Põlder, A.; Juurma, M.; Tamre, M. (2014). Optimal use of spectral information for waste paper detection. In: Proceedings of the 9th International DAAAM Baltic Conference "INDUSTRIAL ENGINEERING", 24-26th April 2014, Tallinn, ESTONIA: 9th International DAAAM Baltic Conference "Industrial Engineering", Tallinn, Estonia, 24-26. April 2014. Tallinn: Tallinn University of Technology, 273 - 277.

3. Roosileht, I.; Lentsius, M.; Mets, O; Heering, S; Hiiemaa, M. & Tamre, M. (2014). Automated inspection system of electric motor stator and rotor sheets. In: Proceedings of the 9th International DAAAM Baltic Conference "INDUSTRIAL ENGINEERING", 24-26th April 2014, Tallinn, ESTONIA: 9th International DAAAM Baltic Conference "Industrial Engineering", Tallinn, Estonia, 24-26. April 2014. Tallinn: Tallinn University of Technology, 283 - 288.
4. Shvarts, D., Tamre, M. (2014). Bulk material volume estimation method and system for logistic applications. In: Proceedings of the 9th International Conference of DAAAM Baltic, INDUSTRIAL ENGINEERING: 9th International Conference DAAAM Baltic, INDUSTRIAL ENGINEERING, Tallinn, Estonia, 24-26 April 2014. Tallinn: Tallinn University of Technology, 289 - 294.
5. Patentne leiutis: Meetod ja seade tallatugede valmistamiseks; Omanik: Tallinna Tehnikaülikool, AS Gadox; Autorid: Mart Tamre, Ahti Põlder, Maido Hiiemaa, Marko Tilk; Prioriteedinumber: P20140003; Prioriteedikuupäev: 31.01.2014

2.2 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest.

Trieu Minh Vu, Awarded Mechatronics, Informatics and Control Group's ***Donald Julius Groen Prize*** for 2012 (awarded in 2013 and information to author sent out in 2014 January). Title of the awarded paper: 'Clutch control and vibration reduction for a hybrid electric vehicle', published in Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering 2012; 226 867-874 Originally published online 13 June 2012.

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

- Prof. M.Tamre - Membership of Professional Societies
  - IEEE (Robotics and Control)
  - ASME
  - Robotics Industries Association (RIA)
  - AUVSI (Association for Unmanned Vehicle Systems International)
- Prof. T.M.Vu - Membership of Professional Societies:
  - Member of Institute of Electrical and Electronics Engineering – Control System Society (IEEE-CSS).
  - Member of Asian Control Association (ACA).
  - Member of review Committee of Asian Journal of Control (AJC).
  - Member of review Committee of International Symposium on Neutral Networks (ISNN).
- Dots. G.Arjassov
  - Sankt- Peterburi Teaduste Maja ehitusmehaanika ja tugevusõpetuse teadusseltsi auliige ning toimetuskolleegiumi liigerahvusvaheliste konverentside orgkomitee liige.
- Tiia Tammaru
  - Eesti Juhtimiskvaliteediauhind 2010, zürii esimees
  - Eesti Kvaliteediühing, juhatuse esimees
  - EVS tehniline komitee 33 'Juhtimissüsteemid', liige
  - European Organization for Quality (EOQ), asepresident
  - Eesti Kutseõppeasutuste Kvaliteediauhind, ekspert
  - Eesti Juhtimiskvaliteedi Auhind Ekspertrühma liige / juhtiv ekspert

- European Organization for Quality (EOQ) Juhatuse liige
- Eesti Kvaliteediühing Juhatuse liige

- Prof. Toomas Kübarsepp
  - Eesti Standardikeskuse Nanotehnoloogia tehnilise komitee asutajaliige
  - Euroopa regionaalse metroloogiaorganisatsiooni EUROMET Eesti Vabariigi delegaat
  - Metroloogianõukogu liige (EV Majandus- ja Kommunikatsiooni-ministeerium)

2.4 Aruandeaastal saadud T&A-ga seotud tunnustused (va punktis 2.3 toodud tunnustused), ülevaade teaduskorralduslikust tegevusest, teadlasmobiilsusest ning hinnang oma teadustulemustele.

Trieu Minh Vu

1. Executive Editor: Global Journal of Technology and Optimization, ISSN: 2229-8711, http://www.omicsonline.com/open-access/editorialboardGJTO.php
Standing Member: Technical Committee (TC) of International Federation of Automatic Control (IFAC) on Automotive Control, http://tc.ifac-control.org/7/1/members
2. International Conf. RTUCON2014 program committee member

Toomas Kübarsepp

1. 9 th International DAAAM Baltic Conference, INDUSTRIAL ENGINEERING, International programm committee member

Mart Tamre

1. 9 th International DAAAM Baltic Conference, INDUSTRIAL ENGINEERING, International steering committee member
2. 10th France - Japan Congress & 8th Europe - Asia Congress on Mecatronics, International steering commitee member, International scientific commitee member
3. Ajakirja "Scientific and Technical Journal of Information Technologies Mechanics and Optics" St.Petersburg, Russia, toimetuskolleegiumi liige
4. Leedu riiklike ülikoolide „Electronic and Electrical Engineering and Robotics“ õppekavade (6 õppekava) hindamiskomisjoni liige
5. Riia Tehnikaülikooli doktorandi Ilze Anderzone doktoritöö „THE DEVELOPMENT AND IMPLEMENTATION OF HYBRID MAP MERGING METHOD“ välisoponent
6. Mehhatroonikainseneri 6…8 taseme kutsestandardi väljatöötamise töögrupi juht, Kutsekoda.

2.5 Hinnang mehhatroonikainstituudi tegevusele aruandeaastal

Publikatsioonide, patenditaotluste ja doktoritööde osas oli aruandeaasta mehhatroonikainstituudile suhteliselt keskmine, võrreldes möödunud aastatega. Instituudi tegevusele jättis tugeva pitseri V korpuse remont ja sunnitud tegevus väga ajutistes ja kokkusurutud ruumides pead-jalad koos, kus laboriruumi teadustööks äärmuseni nappis ning

sellele järgnenud kaootiline kolimine ja mööbli saabumine, kus ükski eelnevalt paika pandud tähtaeg ei kehtinud, põhitöö kolimise ja laborite sisseseadmisega tuli teha ära mõne nädalaga septembri alguses, kus õppetöö juba käis. Sellist pealesunnitud töökorraldust tuleb lugeda TTÜ-s täiesti ebanormaalseks ja töötajavaenulikuks.

Positiivsena võib välja tuua senisest enamat instituudi tegevuste konsolideerumist mehhatroonika, kui interdistsiplinaarse valdkonna suunale, mis küll on tähendanud senisest enamat lahknemist mehaanikateaduskonna üldisest masinaehituse ja materjalitehnika suunast.

Sellega seoses on kerkinud järjest enam päevakorda küsimus, kas niisugune interdistsiplinaarne suund, nagu seda on mehhatroonika, üldse sobib materjali- ja tootmistehnoloogiatele fokuseeritud teaduskonda, kuna nende erialade väga erinev taust muudab äärmiselt raskeks erinevate arenguvajaduste ja –võimaluste mõistmise praeguses mehaanikateaduskonna struktuuris.

Kokkuvõttev hinnang aruandeaasta tulemustele on „hea“.