

University Academic Curriculum Vitae

Personal information Tanel Aruväli

Education since leaving school

- 2005, Bachelor of Science in Production Engineering (Tallinn University of Technology, Estonia)
- 2009, Master of Science in Product Development and Production Engineering (Tallinn University of Technology, Estonia)
- 2015, dissertation titled “Wireless Real-Time Monitoring of Machining Processes”, Doctor of Philosophy in Production Engineering (Tallinn University of Technology, Estonia)

Present appointment

- Research Assistant
- 01.08.2024
- Free University of Bozen-Bolzano, Faculty of Engineering
- Execution of the research project Research on Engineering Education 5.0 Learning Factories. I support the activities of the macro-area Industrial Engineering and Automation with a focus on the relocation of the laboratories (including the Smart Mini Factory Laboratory) to the NOI Techpark Bolzano. The activity includes the planning and design of the new laboratories with regard to the set-up as a learning factory laboratory according to the guidelines of the International Association of Learning Factories (IALF). This includes the planning and implementation of the relocation, layout planning and planning of the equipment, the didactic demonstrators, the involvement of students and specialists as well as the preparation of research papers and publications in the research area of Engineering Education for Industry 5.0.

Professional experience

From / to	Job title	Name of academic Institution	Academic level	responsibilities
December 2004 / June 2005	Apprentice	Rinaldo Production OÜ		Operating of Amada press break; assistant in die cutting machinery, in guillotine station and in assembly station
March 2006 / June 2006	Industrial engineer	Rinaldo Production OÜ	Bachelor	Working with CAD and CAM software to create machining programs for the press brakes, and planning the bending tools purchases for press brakes.
January 2007 / March 2010	Project manager	Laserstuudio OÜ	Bachelor	Customer communication, price calculations, purchase of materials, project preparation for manufacturing, production planning, reclamations and quality issues
February 2013 / June 2013	Guest researcher	Saarland University, Chair in Information and Service Systems	Master	Approach to Industry 4.0; Industry 4.0 concepts integration into my research
April 2010 / May 2020	Project manager	Nordic Plast OÜ	PhD	Implementing and operating ERP software Monitor ; participating in R&D projects as a project manager and as an executor
January 2022 / December	Research Assistant	Free University of Bozen-Bolzano	PhD	Execution of the Bolzano province-funded project „Increasing Resilience in

2023				Manufacturing - Development of a Digital Twin Based Worker Assistance"
January 2024 / July 2024	Research Assistant	Free University of Bozen-Bolzano	PhD	Execution of the Horizon Europe funded project A Strategic Roadmap Towards the Next Level of Intelligent, Sustainable and Human-Centred SMEs

Participation in exhibitions (where applicable)

- Alihankinta (exhibiting in machining industry subcontractors trade fair to introduce machining capabilities of Laserstuudio), September 2009, Tampere, Finland
- Butiksleverantör (exhibiting in retail trade fair to introduce machining capabilities of Nordic Plast), April 2011, Kista, Sweden
- Myymälä (exhibiting in retail trade fair to introduce machining and engineering capabilities of Nordic Plast), March 2012, Helsinki, Finland
- Butiksleverantör (exhibiting in retail trade fair to introduce machining and engineering capabilities of Nordic Plast), March 2012, Kista, Sweden
- Shop Nordic (exhibiting in retail trade fair to introduce machining and engineering capabilities of Nordic Plast), April 2014, Kista, Sweden
- Shop Nordic (exhibiting in retail trade fair to introduce machining and engineering capabilities of Nordic Plast), April 2016, Kista, Sweden
- Euroshop (exhibiting in retail trade fair to introduce machining and engineering capabilities of Nordic Plast), March 2017, Düsseldorf, Germany
- Elmia Subcontractor (exhibiting in machining industry subcontractors trade fair to introduce machining and engineering capabilities of Nordic Plast), November 2018, Elmia, Sweden
- Euroshop (exhibiting in retail trade fair to introduce machining and engineering capabilities of Nordic Plast), February 2020, Düsseldorf, Germany

Experience in academic teaching

- Advanced Manufacturing Technologies and Systems, Free University of Bozen/Bolzano, engineering, post-graduate

Other academic responsibilities

- Member of a thesis committee for a Doctoral thesis (S. Kaganski "Development and Implementation of the Key Performance Indicator Selection Model for SMEs"), Tallinn University of Technology, June 2018
- Member of the thesis committee for Master thesis in the study program of Production Engineering, Tallinn University of Technology, 2016 – 2020
- Reviewer for publications in the: (i) International Conference Modern Materials and Manufacturing 2021 (MMM2021), (ii) International Conference Modern Materials and Manufacturing 2023 (MMM2023), (iii) International Symposium on Industrial Engineering and Automation (ISIEA2023), (iv) Q1 journal Production and Manufacturing Research (2023), (v) Q1 journal Scientific Reports (2023).
- Member of the committee assigning occupational qualifications for Mechanical Engineers in Estonia, Union of Estonian Mechanical Engineers, 2018 - 2023

Memberships

- Member of the organizing committee of the International Symposium on Industrial Engineering and Automation (ISIEA2022)

Research and

- Project "A Strategic Roadmap Towards the Next Level of Intelligent,

scholarships

Sustainable and Human-Centred SMEs” aims developing a roadmap for sustainable, resilient, human-centric and intelligent future SMEs. I applied Axiomatic Design method for decomposing design parameters for resilient Cyber Physical Production Systems. I was researching Zero Trust principles in Industry 5.0 manufacturing companies’ context and resilience requirements for SMEs in CPPS environment, and stakeholder responsibilities and its ethics in Industry 5.0 context.

- Project “Increasing Resilience in Manufacturing - Development of a Digital Twin Based Worker Assistance”. The research aimed to increase resilience in human-centered SME manufacturing companies by merging cognitive assistance-supported workstation with a real-time connected ERP and MES systems, and digital twin that enables real-time optimization of related work processes through safe human-machine interactions. For practically usable resilience metrics evaluation and selection for industrial companies, I applied Analytic Hierarchy Process multicriteria decision making methods. Based on the selected metric, I proposed 2-layer monitoring architecture for long-term resilience. I applied Axiomatic Design methods for decomposing cyber resiliency and digital shadow as essential components for Cyber Physical Production Systems. Research was supported by autonomous Provinz Bozen – Südtirol.
- In Nordic Plast I participated in various research projects. The projects were as follows: experimental research project „Remote identification of machinery working modes”; research and development project “Digital factory”; research project of optimization of production technology in bending of 5+ mm thickness polycarbonate sheet plastic; research project „Personal efficiency based production planning in assembly station in mass customization environment”.
- Research grants and contracts

Date granted	Award Holder(s)	Funding Body	Title	Amount received
November 2021	UNIBZ (Prof Erwin Rauch and Dr Tanel Aruväli)	Autonome provinz Bozen – Südtirol	Increasing Resilience in Manufacturing - Development of a Digital Twin Based Worker Assistance	169 500 €

Publications

- Conference papers (published)
- Aruväli, T.; Serg, R.; Preden, J.; Otto, T. (2010). Smart dust applications in production environment. Proceedings of the 7th International Conference of DAAAM Baltic “Industrial Engineering”, 572–577.
- Aruväli, T.; Serg, R.; Otto, T.; Preden, J. (2010). Monitoring of manufacturing machinery using smart dust applications. Proceedings: 9th International Symposium "Topical Problems in the Field of Electrical and Power Engineering", 209–213.
- Aruväli, T.; Otto, T.; Preden, J. (2010). Modern monitoring opportunities in shopfloor. Proceedings of the 21st International DAAAM Symposium "Intelligent Manufacturing & Automation", 989–990.
- Aruväli, T.; Otto, T.; Serg, R. (2011). In-process vibration monitoring on CNC lathe. Proceedings: 10th International Symposium "Topical Problems in the Field of Electrical and Power Engineering", 174–178.
- Aruväli, T.; Reinson, T.; Serg, R. (2011). Real-time machinery monitoring applications in shop floor. Proceedings of the World Congress on Engineering and Computer Science, 1, 337–342.
- Astapov, S.; Preden, J.-S.; Aruväli, T.; Gordon, B. (2012). Production machinery utilization monitoring based on acoustic and vibration signal analysis. Proceedings of the 8th International Conference on DAAAM Baltic “Industrial Engineering”, 268–273.

- *Aruväli, T.*; Serg, R.; Otto T. (2012). Machinery utilization monitoring and pause identification prototype model design. Proceedings of the 8th International Conference on DAAAM Baltic "Industrial Engineering", 256–261.
- *Aruväli, T.* (2012). Machinery real time monitoring application planning for workshop. Proceedings: 12th International Symposium "Topical Problems in the Field of Electrical and Power Engineering", 142–144.
- *Aruväli, T.*; Serg, R.; Kaare, K.; Otto, T. (2012). Monitoring system framework and architecture over supply chain. Proceedings of the 23rd International DAAAM Symposium "Intelligent Manufacturing & Automation", 661–667.
- *Serg, R.*; Aruväli, T.; Otto T. (2014). Power consumption based online condition monitoring in milling machine. Online Proceedings of the 9th International DAAAM Baltic Conference "Industrial Engineering", 193–197.
- *Astapov, S.*; Riid, A.; Preden, J.-S.; Aruväli, T. (2014). Industrial process monitoring by multi-channel acoustic signal analysis, Proceedings of Doctoral Session of BEC 2014, 209–212.
- *Rauch, E.*; Aruväli, T. (2021). Resilience in manufacturing during covid-19 through digital worker assistance systems. Proceedings of the 14th EPIEM Conference 2021, 41–47.
- *Aruväli, T.*, Rauch, E. (2022). ERP and digital planning in learning factories for increasing digital resilience. Proceedings of the 15th EPIEM Conference 2022: 15th EPIEM Conference 2022 "Creating a European IEM Future at the Intersection "Innovation – Digitalisation – Sustainability", 66–71.
- *De Marchi, M.*, Rojas, R., Mark, B., Aruväli, T., Rauch, E., Matt, D. (2022). Digital twin architecture of a cyber-physical assembly transfer system. Proceedings of the 3rd International Conference on Innovative Intelligent Industrial Production and Logistics: Conference on Innovative Intelligent Industrial Production and Logistics - IN4PL, Malta. SCITEPRESS – Science and Technology Publications, Lda, 168–175.
DOI: 10.5220/0011589900003329.
- *Nezzi, C.*, De Marchi, M., Aruväli, T., Vidoni, R., Rauch, E. (2023). Implementation of 3D simulation to foster digital twin based applications in manufacturing: an educational case study. Proceedings: 13th Conference on Learning Factories 2023, Reutlingen, 9-11 May 2023. SSRN. DOI: 10.2139/ssrn.4469934.
- *Nezzi, C.*, De Marchi, M., Aruväli, T., Cochran, D.S., Rauch, E. (2023). Demonstrating the potentials of digital twin in manufacturing: an axiomatic design-based application for engineering education. In: Borgianni, Y., Matt, D.T., Molinaro, M., Orzes, G. (eds) Towards a Smart, Resilient and Sustainable Industry. ISIEA 2023. Lecture Notes in Networks and Systems, 745. Springer, Cham. https://doi.org/10.1007/978-3-031-38274-1_3.
- *De Marchi, M.*, Mark, B.G., Aruväli, T., Rauch, E., Matt, D.T. (2023). IoT Based Monitoring in Learning Factories for Education in Smart and Sustainable Manufacturing. In: Auer, M.E., Langmann, R., Tsiatsos, T. (eds) Open Science in Engineering. REV 2023. Lecture Notes in Networks and Systems, vol 763. Springer, Cham. https://doi.org/10.1007/978-3-031-42467-0_88.
- *Aruväli, T.*, De Marchi, M., Rauch, E., Matt, D. (2024). Design Decomposition for Cyber Resiliency in Cyber-Physical Production Systems. In: Puik, E., Cochran, D.S., Foley, J.T., Foith-Förster, P. (eds) Proceedings of the 15th International Conference on Axiomatic Design 2023. ICAD 2023. Lecture Notes in Networks and Systems, vol 849. 3-14. Springer, Cham. https://doi.org/10.1007/978-3-031-49920-3_1.
- *Aruvali T.*, De Marchi M., Rauch E. (2024). Monitoring system architecture for long-term resilience in manufacturing. AIP Conference Proceedings, vol 2989(1). AIP Publishing. <https://doi.org/10.1063/5.0189301>.

- Conference papers (accepted)
- *Aruväli, T.*, De Marchi, M., Rauch, E., Matt, D. Cyber-Physical Production System Design Decomposition for Internal Disruption Avoidance. 7th International Conference on Design, Simulation, Manufacturing: The Innovation Exchange (DSMIE-2024).
- *Aruväli, T.*, Rauch, E., Matt, D., Francalanz, E. SMEs' Requirements for Resilient Cyber-Physical Production System. International Conference on Industry 4.0 and Smart Manufacturing (ISM2024).
- *Hofer, A.*, Aruväli, T., Rauch, E., Matt, D. „The Change from Shareholder Value to Stakeholder Value within Industry 5.0”. International Conference on Industry 4.0 and Smart Manufacturing (ISM2024).
- Journal articles in refereed academic journals
- *Aruväli, T.*; Serg, R.; Preden, J.; Otto T. (2011). In-process determining of the working mode in CNC turning. Estonian Journal of Engineering, 17(1), 4–16. Doi.org/10.3176/eng.2011.1.02.
- (*) *Snatkin, A.*; Karjust, K.; Majak, J.; Aruväli, T.; Eiskop, T. (2013). Real time production monitoring system in SME. Estonian Journal of Engineering, 19(1), 62–75. Doi.org/10.3176/eng.2013.1.06
- (*) *Aruväli, T.*; Maass, W.; Otto T. (2014). Digital object memory based monitoring solutions in manufacturing processes. Procedia Engineering, 69, 449–458. Doi.org/10.1016/j.proeng.2014.03.011
- (*) *Aruväli, T.*, De Marchi, M. & Rauch, E. Analysis of quantitative metrics for assessing resilience of human-centered CPPS workstations. Scientific Reports 13, 2914 (2023). <https://doi.org/10.1038/s41598-023-29735-1>.

Further data

- Presentations at scientific conferences over past 3 years (selected):
- ERP and digital planning in learning factories for increasing digital resilience. 15th EPIEM Conference 2022 “Creating a European IEM Future at the Intersection “Innovation – Digitalisation – Sustainability”, Graz, Austria, 01-04.06.2022.
 - Monitoring system architecture for long-term resilience in manufacturing. Modern Materials and Manufacturing (MMM2023), Tallinn, Estonia, 02-04.05.2023

Entrepreneurship

2010 – 2020 partner in manufacturing and engineering company Nordic Plast OÜ, Estonia

Date 01.08.2024

Signature