UNIVERSITY OF LJUBLJANA
Faculty of Mechanical Engineering

Smart Factories (6053-M) 5 ECTS

Lecturer: **N. Herakovič, M. Šimic, M. Pipan**

Lectures: 30h | Tutorials: 6h | Labs: 24h | Project: 0h | Lang. :

Objectives

The students will gain, basics and essence of smart factories and Industry 4.0 (I 4.0) and the concept of distributed systems and development of digital twins of processes in smart factories. The main objectives are the following: 1) To gain basic concepts and approaches to design of smart factories and to learn about key technologies of I 4.0 and the concept of distributed systems; 2) To gain the basics of development of digital twins of processes in a smart factory based on the modelling of discrete and partially continuous events and to learn the basics of control of smart factories with the help of digital twins and digital agents; 3) Ability to estimate the level of digitalization of existing factories and understanding the concepts and approaches to designing smart factories or for transforming existing factories towards a smart factory; 4) Understanding the key technologies of I 4.0 and their role and usefulness in a smart factory; 5) Understanding and creation of digital twins of processes in a smart factory based on discrete and partially continuous events and to use digital twins and digital agents for control of a smart factory.

Programme

The programme is focused on smart factories and their definitions, concepts and development approaches; disciplines, systems and technologies related to Industry 4.0; referential architectural models of smart factories and concept of distributed systems; top-down and bottom-up approach when implementing solutions of I 4.0; the concept of digital twins (DT) of manufacturing processes of a smart factory; five-dimensional modelling of a DT and its key technologies; control of a smart production with a digital twin; advanced production systems integration into a smart factory.

Prerequisites

Meeting the enrolment conditions for the Master's study programme of Mechanical Engineering - The condition for admission to exam is a passing grade for exercises and other individual assignments.

Learning outcomes

After attending this course, the student knows and understands the content and mission of a smart factory compared to traditional factories; acquired knowledge is used by the student to draft and design processes in smart factories and to integrate them into the whole concept of a smart factory, to make effective use of I 4.0 technologies in a smart factory, and to produce digital twins of processes and the entire smart factory, as well as to control the whole system; to learn about key technologies of I 4.0 and the concept of distributed systems; knows and understands how to use of tools to evaluate the status of digitization of a traditional factory and computer-aided tools for drafting an efficient smart factory for various purposes and recognize of the usefulness of I 4.0 technologies in a smart factory and knows and understands how to use simulation tools for building a digital twin of a smart factory with different subprocesses.

Assessment

Contribution to the final grade:

- 50% theoretical contents (lectures, team work): Colloquium, team work presentation/defence, writing and/or oral exam
- 50% individual work in exercises, individual laboratory work (including reports).

Literature

Tao, F., Zhang, M., Nee, A.Y.C.: Digital Twin Driven Smart Manufacturing, Elsevier, 2019 / Barrenechea, M., J., Jenkins, T.: Digital Manufacturing, Open Text Corporation, 2018 / Schwab, K.: Četrta industrijska revolucija, World Economic Forum, 2016 (Slovene) / Heynitz, H. et. al.: The factory of the future, Part 1, KPMG, 2016 / Moon, I. et. al.: Advances in Production Management Systems – Smart Manufacturing for Industry 4.0, APMS 2018, Proceeedings, Part II, Seoul, Korea, 2018 / Burke, R., et. al.: The smart factory – Responsive, adaptive, connected manufacturing, Deloitte University Press, 2017 / Regber, H., Christian, M.: Introduction to Industry 4.0 – core elements and business opportunities, Festo Didactic SE, Germany, 2017.