Institute of Production Engineering
School of Industrial Engineering and Management

P43 – (FMG3915) Disturbance and Variation Analysis in Manufacturing Systems.

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General Information

This is a 9-credit doctoral course that covers advanced topics in data-driven analysis of disturbances and variations in manufacturing processes. The course focuses on the application of data-driven methods, including data preprocessing, machine learning and deep learning techniques, and how these methods augment physics-based process models.

Course Intended Learning Outcomes (ILOs):

1. **Develop** data-driven models by applying pre-processing, feature engineering, regression, and classification techniques for process analysis and predictive modelling.
2. **Implement** anomaly detection models using machine learning to identify deviations.
3. **Build** reduced order models as digital models to approximate complex manufacturing processes for efficient simulation and optimization.

Course structure and content

The course is divided in the following three modules:

Module 1: Data Driven Models

Module 2: Predictive Modeling

Module 3: Anomaly Detection

Module 4: Building Digital Twins

Each module consists of sessions composed of lectures and student presentations. There will be five full-day sessions **(09:00 – 15:00)** scheduled for **autumn 2025** as shown below.

Date	Content
4th of September	Module 1
18th of September	Module 2
2nd of October	Module 3
16rd October	Module 4
30th October	Presentations

Prerequisite and prior knowledge.

There are no prerequisite courses. However, prior knowledge in probability and statistics and use of computational tools facilitates the learning.

Home Take Tasks

Assignments are issued after each module's lecture which the students should complete and present in the following session. Students are encouraged to use their own research topics as the ambition in the course is that the efforts lead to publications.

Assessment

Each module has equal weights towards the final assessment. The course will be graded on Pass or Fail basis. To pass the course, it's obligatory to attend all the sessions, complete and present the assignment.

Placement

The number of students is limited to eight (8). Information on course registration can be found on 'kunskapsförmedling' website https://kunskapsformedlingen.se/en/courses/.

Course Literature

1 Lecture notes
2 Reference material to be provided in the lectures.