

2024 ME 410 Mechanical Product Design and Development

Prof. Jamie Paik

jamie.paik@epfl.ch

MOTIVATION

Study and nurture the creativity and decision-making processes in constructing solutions by being immersed in A to Z of product development. In-depth analysis of the operation principles, advanced meso-scale technologies, and production for their applications in wearables.

CONTENT

Study and explore design principles of the different mechatronic components and systems. We will cover in-depth meso-scale actuators, sensors, and platform constructions. We will look at the design and working principles of various smart systems and 3D architectures in the current state-of-the-art at both academic and industrial levels. Half of the course is dedicated to understanding established design methodologies that dictate various product design processes. The final report and presentation should reflect the considerations made toward the covered methodologies.

EVALUATION

70% Project (20 % Final Report, 20 % Final Presentation, and 30 % Working Prototype)

30% Participation (Weekly presentations + participation)

KEYWORDS

Wearable technology, Soft sensors and Actuators, Smart actuators, Flexures, Compliant mechanisms. Polymer, Product design, Design methodology

LEARNING OUTCOMES

By the end of the course, the student must be able to:

- Choose suitable methods and tools for (a) the development of, (b) the modeling and simulation of, (c) the analysis of and (d) the choice of solution for an engineering problem in the mechanical engineering domain (product design, manufacturing process and system production)
- Analyze/listen to the customer requests and define the specifications
- List the functions of an existing or new product based on the specifications
- Choose the main conceptual design solutions and identify the respective components to fulfill one function, taking into account the performance, technology and price constraints
- Formulate the modeling hypotheses to tackle a problem and choose solution methods and tools considering the available resources
- Choose the models and analysis criteria following the specifications

- Describe the technology implemented in advanced systems (actuators and sensors)
- Prototype a functional device considering the scaling laws and boundary conditions involved

Design project and grading

- Students work in groups of 5 to define and solve the chosen open-ended problem.
- Everyone in the group will receive the same final grade for the report / presentation / prototype but participation grade may vary.
- Each group is expected to produce update slides prior to the class for presenting to the class.
- All the written materials should follow the sample format on moodle.

Final poster, flyer, demo video, presentations (private & public)

Working Prototype Demo for the Public Presentation on 6th Dec (9-15h).

- A budget of **150 CHF** + Arduino kit + mechanical assembly tool kit are allocated toward building a prototype for each group
- High importance on the creative solution, working concept, and a functioning prototype

Final Presentation in class 13th Dec

- 1 representative from each group will present for total of 15 min and followed by a Q&A session.
- All members should be present.
- 5-7 min question period should be answered by anyone from the group

Final report (format on Moodle, up to 15 pages)

- Soft copy: uploaded on the OneDrive on MOODLE
- Late submission will lose 50 % of the grade.