INTERNATIONAL

Summer SCHOOL

3rd IAAD International Summer School on

AXIOMATIC DESIGN - SYSTEMS ENGINEERING AND DESIGN OF COMPLEX SYSTEMS

16th-18th July 2024

The summer school aims at teaching both scientific foundations, practical methods and helps to develop specific professional skills.

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Fundamental principles of **Axiomatic Design (AD)** are reviewed, with insights and perspectives of over 30 years of teaching and practice. This should be of interest to beginners and to all levels of users.

The latest methods for using AD, qualitatively and quantitatively, for selecting the best design solutions and for fostering innovations are presented. AD, originating with Nam Suh at MIT in the late 1970s, contends that all good designs comply with two axioms: maintaining independence of the functional elements and minimizing information content. AD can add value and reduce costs in designs and in the design process. Participants learn also to use **Mirò software** for the design of complex systems and products.

This tutorial is intended students, PhD students, researchers and design practitioners, who might have never used Axiomatic Design as design theory, or who would like a fresh perspective.

Content Outline

LECTURE:

1. Introduction in Axiomatic Design (AD)

2. Domains in AD

3. Customer Needs, Functional Requirements, Design Parameters, Process Variables and Constraints

4. Independence Axiom and Information Axiom

5. Design Matrix

6. Decomposition and Mapping process

7. MSDD design approach

8. Failure Modes and Effects Analysis (FMEA)

9. Design of Complex Systems and practical examples

Exercise

• Case study elaboration in groups during the exercise hours.

• Introduction in Mirò software for engineering design and application in the group work.

• 12 steps approach for AD.

The lectures of the summer school will be offered in remote by international experts in Axiomatic Design via live streaming.

The exercise part is instead planned as a presence group work session in participating universities.

Agenda Summer School

LECTURES

TUESDAY 16 JULY 2024
AXIOMATIC DESIGN AND DESIGN OF COMPLEX SYSTEMS

2:00 – 2:15 pm	**Welcome** (Erwin Rauch, Ali Bataleblu)
2:15 – 3:00 pm	**Lecture 1 - Origins of AD and Axioms** (Chris Brown)
3:00 – 3:45 pm	**Lecture 2 - Functional Thinking and Fundamentals of AD** (Chris Brown)
3:45 – 4:00 pm	**Break**
4:00 – 4:45 pm	**Lecture 3 - AD within SE Cycle and application with MBSE Tools The vision of MSDD 10** (David Cochran)
4:45 – 5:30 pm	**Lecture 4 - Axiomatic Design within the 12 Step Systems Engineering Lifecycle Design Process** (David Cochran)
5:30 – 6:00 pm	**Question and Answer (+ Groupwork introduction)**

WEDNESDAY 17 JULY 2024
ADVANCED CONCEPTS AND APPLICATIONS OF AXIOMATIC DESIGN AND SE

8:00 – 12:15 am	**Groupwork Part 1** (local Tutors) **(Problem formulation, From CN to FR and C, Top level FR DP)**
2:00 – 2:15 pm	**Wrap up Day 1**
2:15 – 3:00 pm	**Lecture 5 - AD in Everyday Items** (Joe Foley)
3:00 – 3:45 pm	**Lecture 6 - Model-based Systems Engineering (MBSE)** (Alì Bataleblu)
3:45 – 4:00 pm	**Break**
4:00 – 4:45 pm	**Lecture 7 - Computation of the information content** (João Fradinho)
4:45 – 5:30 pm	**Lecture 8 - Failure Modes and Effects Analysis (FMEA)** (Michael Seppi)
5:30 – 6:00 pm	**Question and Answer**

THURSDAY 18 JULY 2024
GRUPWORKS AND PRESENTATIONS

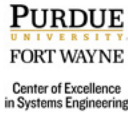|	
8:00 – 12:00 am	**Groupwork Part 2** (local Tutors) **(Decomposition, FR DP tree, FMEA, Validation & Verification)**
12:00 – 2:00 pm	**Break**
2:00 – 4:00 pm	**Groupwork Part 3 (Preparation of presentations)** (local Tutors)
4:00 – 6:00 pm	**Groupwork presentations and discussion** (10 min + 5 min Q&A) **and discussion** (local Tutors)
6:30 – 6:30 pm	**Evaluation and Award Winners** (1st, 2nd, 3rd place) (All)

CASE STUDY IN THE EXERCISE HOURS: Decomposition of a given or own case study
TUTORING: an IAAD member takes over the local tutoring for group works.

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IAAD
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ASSOCIATION FOR
Axiomatic Design

SME 5
A STRATEGIC ROADMAP TOWARDS THE NEXT LEVEL OF
INTELLIGENT, SUSTAINABLE AND HUMAN-CENTRED SMEs

Funded by
the European Union