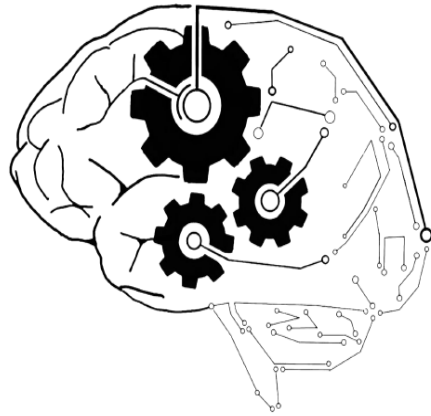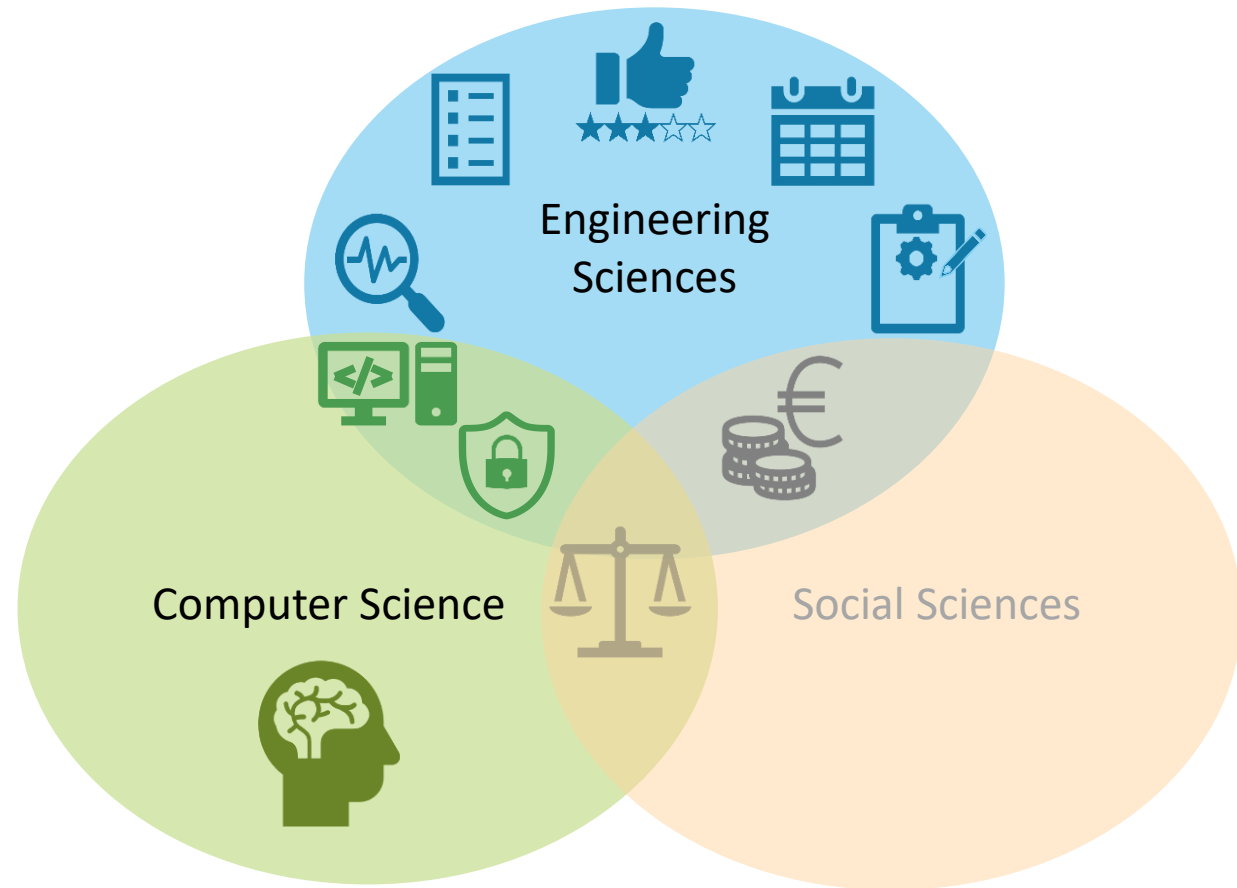# Towards the AI Engineer: Providing a Foundation for Future Engineers with an Integrated Approach to Mechanics Education

Hanna Westphal, Sebastian Lang, Johannes Schleiss

Motivation

New Bachelors Degree Programm at OVGU:
AI Engineering –
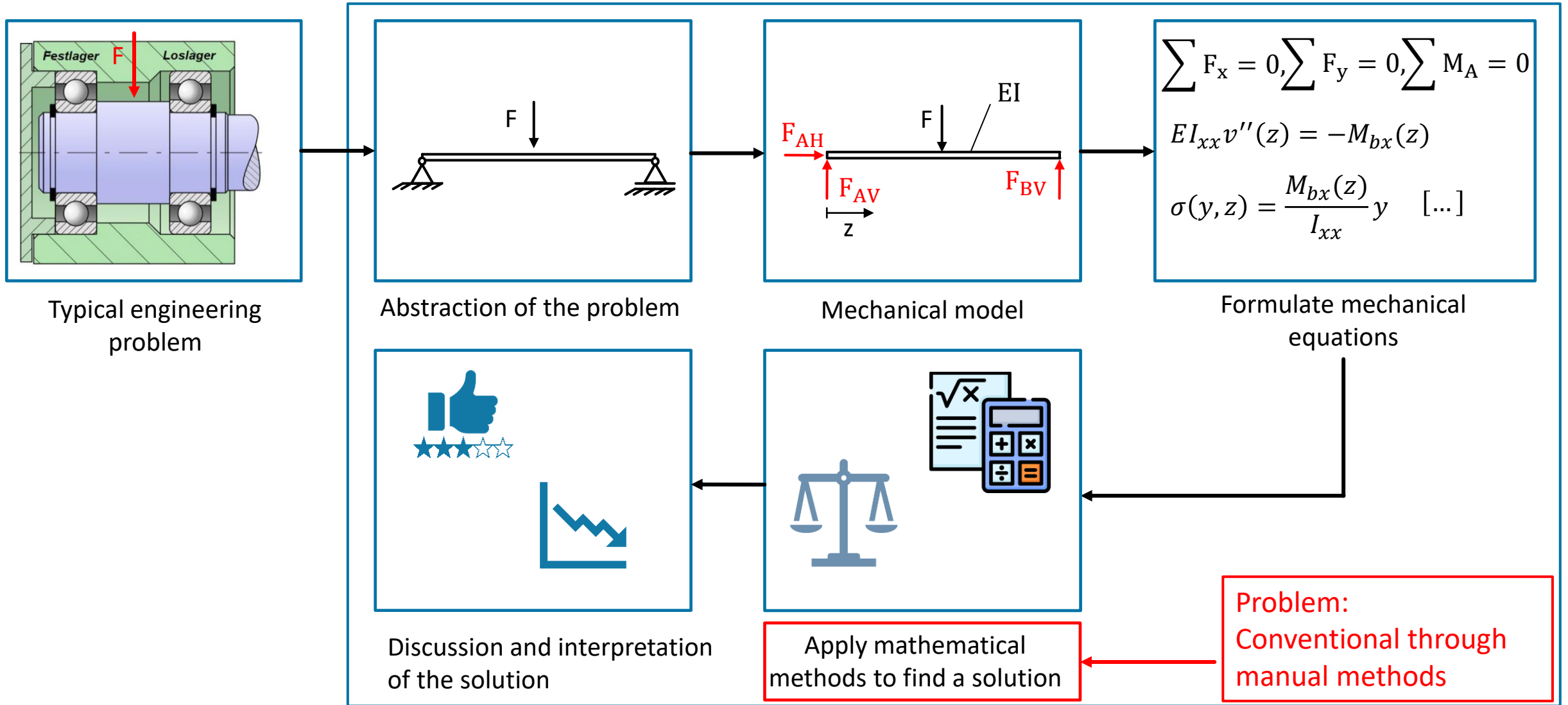Artificial Intelligence in Engineering (B. Sc.)

Engineering Sciences

Computer Science

Social Sciences

AI Engineering Curriculum

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII
5 CP	Engineering Fundamentals (Maths, Mechanical Engineering, Electrical Engineering)			Fundamentals of a selected application domain	Application domain		Industrial internship
5 CP							
5 CP	Methods of AI Engineering						
5 CP	Artificial Intelligence and Computer Science Fundamentals						Bachelor thesis
5 CP							
5 CP	Interdisciplinary project work						

AI Engineering Curriculum


- Closer integration of computer science and engineering education

First Approach to an integrated concept in "Mechanics 1"

The diagram shows a curriculum matrix across Semester I–VII with credit points (5 CP each row):

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII
5 CP	Engineering Fundamentals (Maths, Mechanical Engineering, Electrical Engineering)			Fundamentals of a selected application domain			Industrial internship
5 CP							
5 CP	Methods of AI Engineering				Application domain		
5 CP	Artificial Intelligence and Computer Science Fundamentals						Bachelor thesis
5 CP							
5 CP	Interdisciplinary project work						

Current proceeding - Subject of Mechanics

Typical engineering problem

Abstraction of the problem

Mechanical model

$$\sum F_x = 0, \sum F_y = 0, \sum M_A = 0$$

$$EI_{xx} v''(z) = -M_{bx}(z)$$

$$\sigma(y,z) = \frac{M_{bx}(z)}{I_{xx}} y \quad [...]$$

Formulate mechanical equations

Discussion and interpretation of the solution

Apply mathematical methods to find a solution

Problem: Conventional through manual methods

Enhanced Approach – Digital Integration in Mechanics

$$\sum F_x = 0, \quad \sum F_y = 0, \quad \sum M_A = 0$$

$$EI_{xx} v''(z) = -M_{bx}(z)$$

$$\sigma(y, z) = \frac{M_{bx}(z)}{I_{xx}} y \qquad [\dots]$$
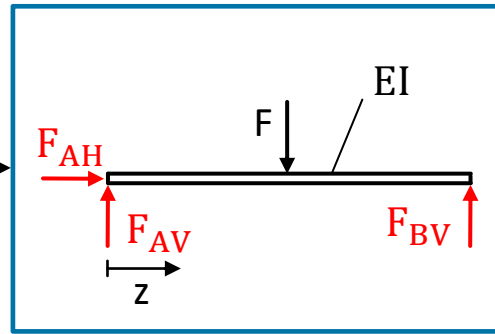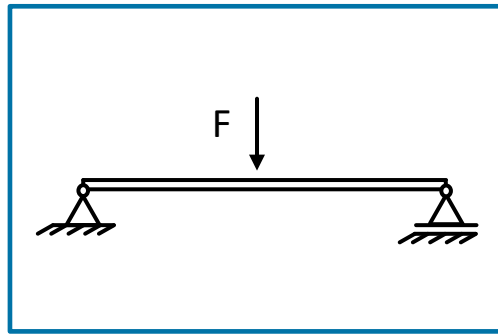
control
&
Parameterization
&
Higher complexity

Application and integration
of programming and
computer algebra systems

Discussion and
interpretation
of the solution

Practical implementation of the concept
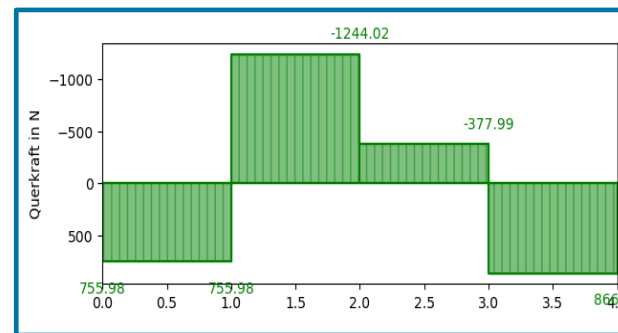
Fact Box

- Application of the concept in exercises

- Instead of a handwritten exam - solving a complex, real-world mechanics problem as an assignment

- Programming language: *Python*

- Development environment: *Jupyter Notebook*

Competency Profile of an AI Engineer
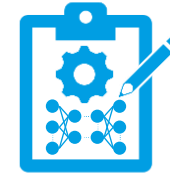
Analyzing problems

Defining requirements

(AI) Problem Solving

Planning and management of (AI) projects

Data and AI Knowledge

IT Competencies

Process- and System Thinking

AI Reflection

Evaluation and improvement of Industrial AI systems with respect to ethical aspects

Evaluation and improvement of Industrial AI systems with respect to economic aspects

Summary and Outlook

- Early development of digital competencies as a foundation

- Stronger interconnection between modules and interdisciplinarity

- Enables more efficient handling of complex problems

- Basis for advanced courses and specializations (e.g., numerical simulation methods)

- Foundation for developing AI-driven solutions in mechanics

AI-Driven Solutions in Fundamental Mechanics

- **Structural Mechanics**: Rapid prediction of deformations and stresses as an alternative to time-consuming FEM analysis
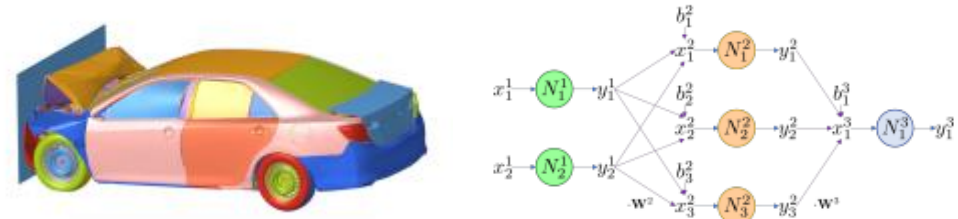
- **Material Modeling**: Material modeling with physics-augmented neural networks

[Maurer, 2024]

mechanical stress

−1   11

Yeoh's constitutive law   Neural Network
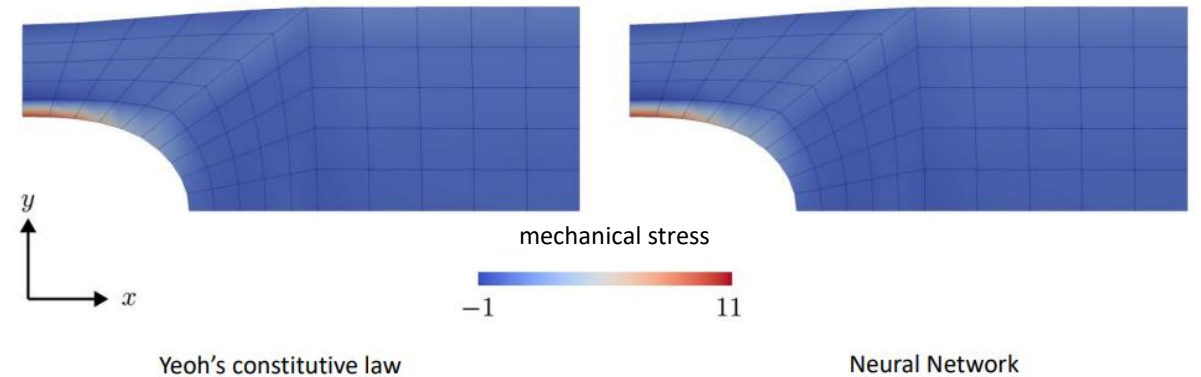
Thank you for your attention

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