Chapter 1. Introduction

This course consists of three parts

1. Finite element formulation
2. Discretization techniques
3. Computer implementation of FEM

Where the course fits

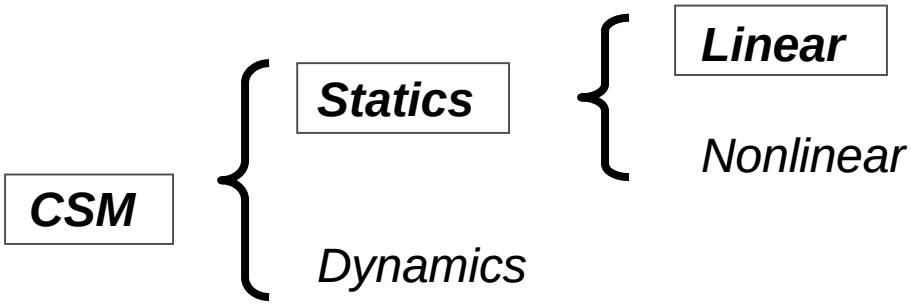
The field of mechanics is divided into three parts

Theoretical
Applied
Computational

Computational mechanics can be distinguished according to the physical focus of attention

Particle
Micromechanics
Solids and structure
Fluids
Coupled systems

Computational Solid and Structural Mechanics (CSM)



For the numerical simulation on the computer we must now choose ***a spatial discretization method***:

CSM Linear Statics

- ***Finite Element Method***
- *Finite Difference Method*
- *Boundary Element Method*
- *Finite Volume Method*
- *Spectral Methods*
- *Mesh-Free Methods*

CSM Linear Statics by FEM

Having selected the FEM for discretization, we must next pick a formulation and a solution method:

Formulation of FEM Model

- ***Displacement***
- *Equilibrium*
- *Mixed*
- *Hybrid*

Solution of FEM Model

- ***Stiffness***
- *Flexibility*
- *Mixed*

Summary: This Course Covers

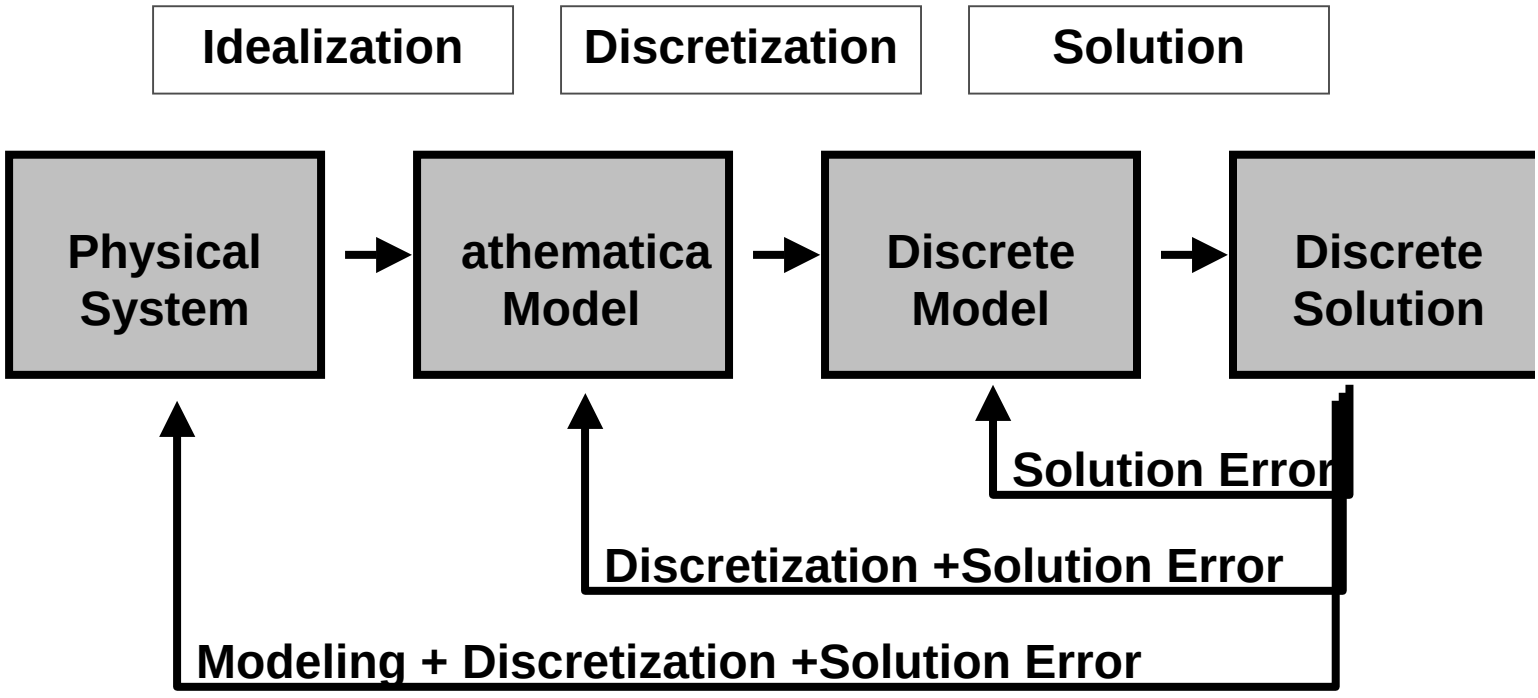
Computational Structural mechanics

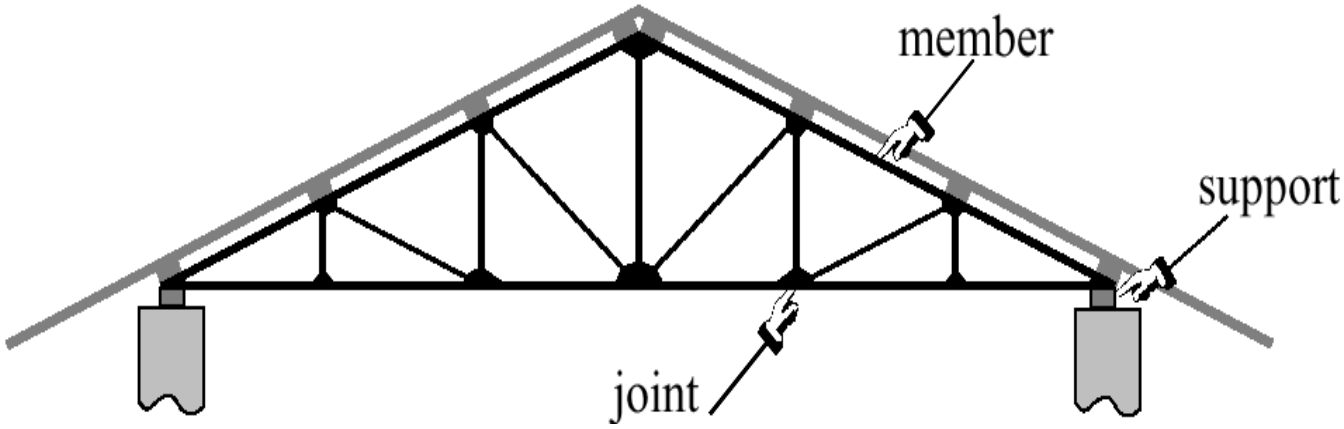
Linear statics problems

Spatially discretized by displacement-formulation FEM

Solved by stiffness method

Role of FEM

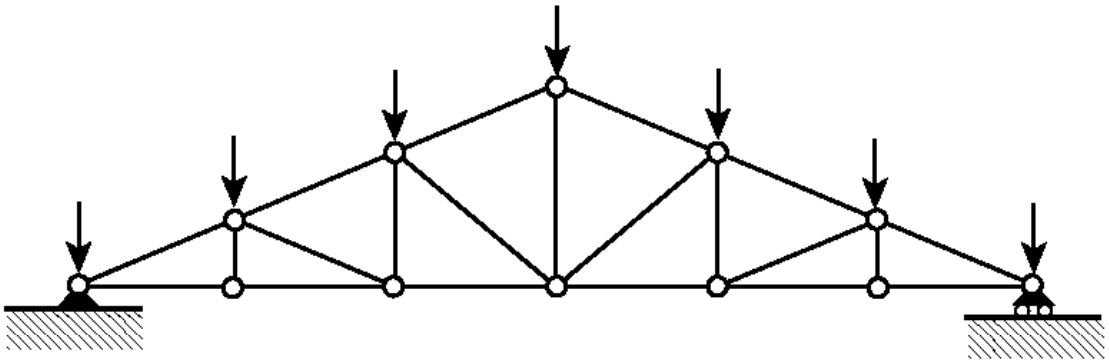




Physical Model

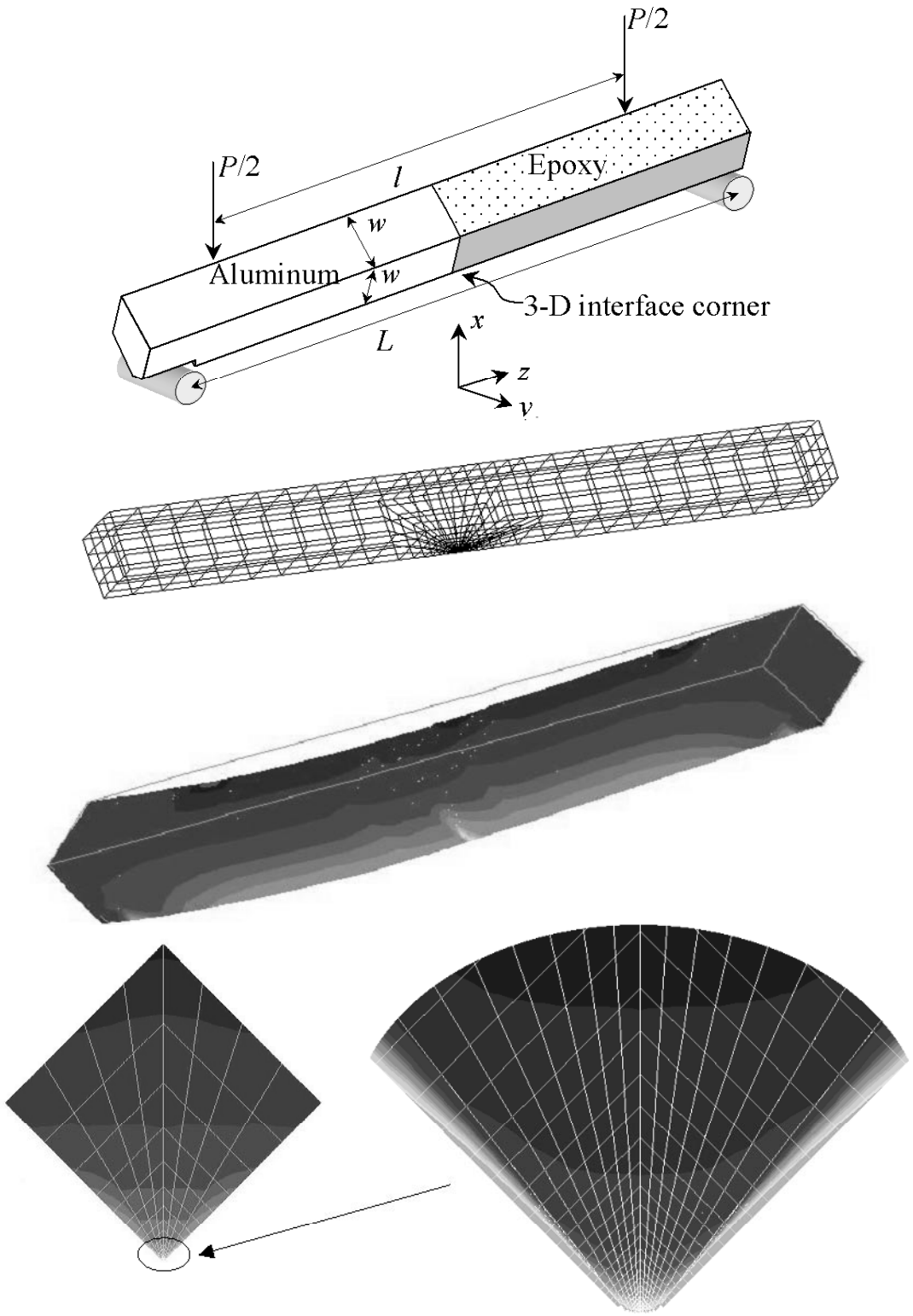
Idealization

Matematical Model

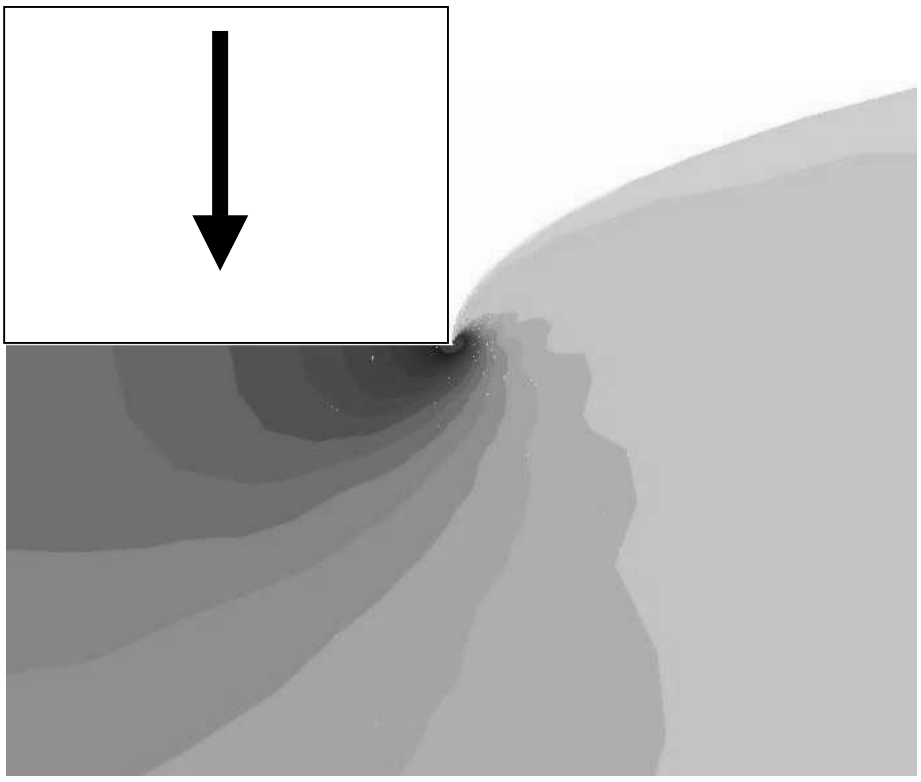


EXAMPLES

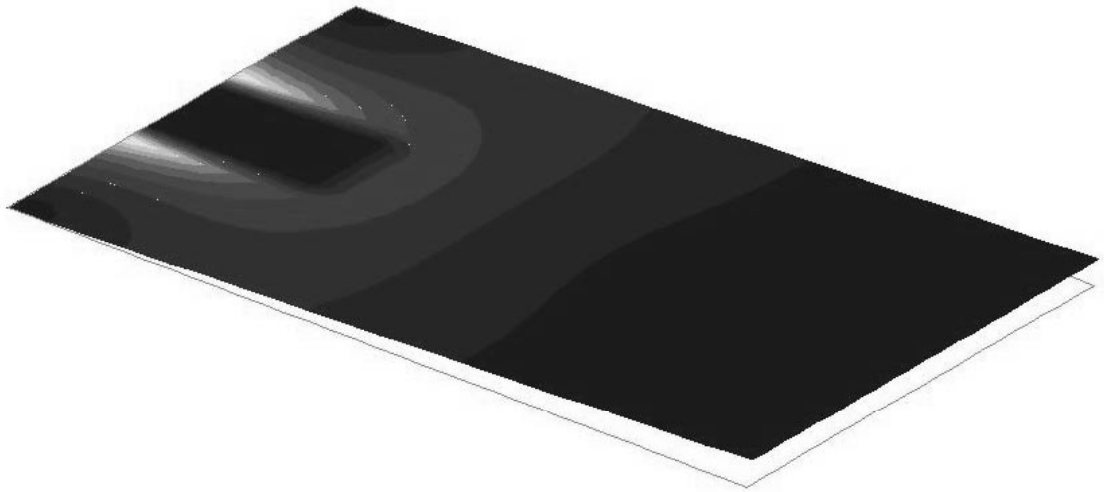
ALUMINUM/EPOXY BIMATERIAL SPECIMEN IN BENDING



RIGID PUNCH ON AN ELASTO-PLASTIC SUBSTRATE

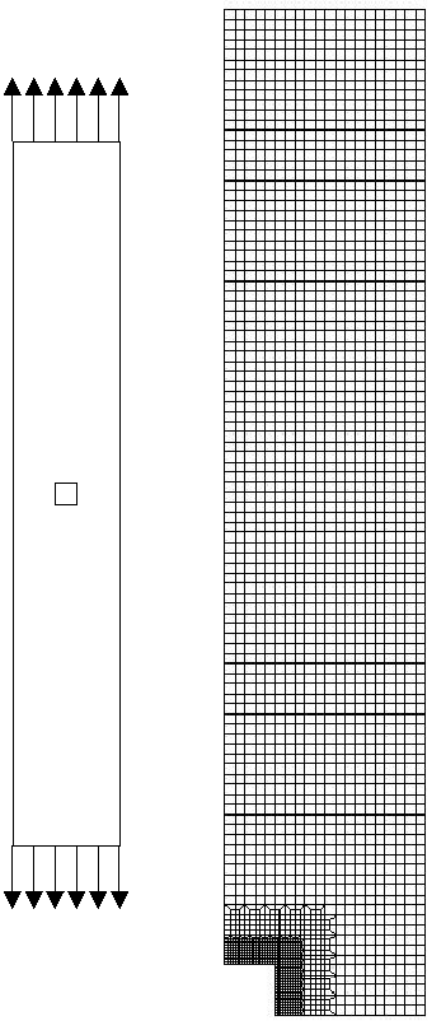


THERMAL INDUCED DEFORMATION OF A MICRO MIRROR



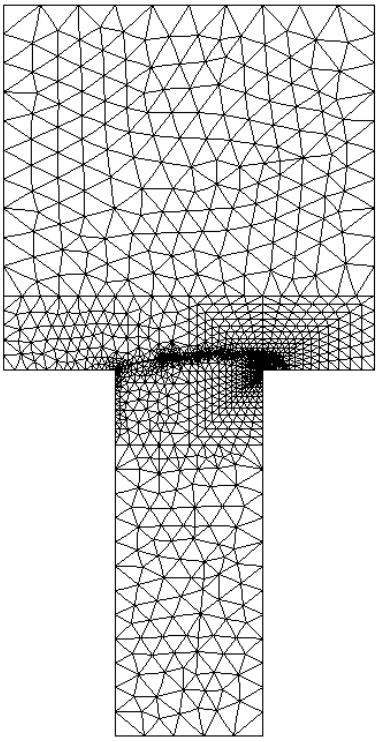
SINGLE CRYSTAL SILICON PLATE WITH SQUARE HOLE

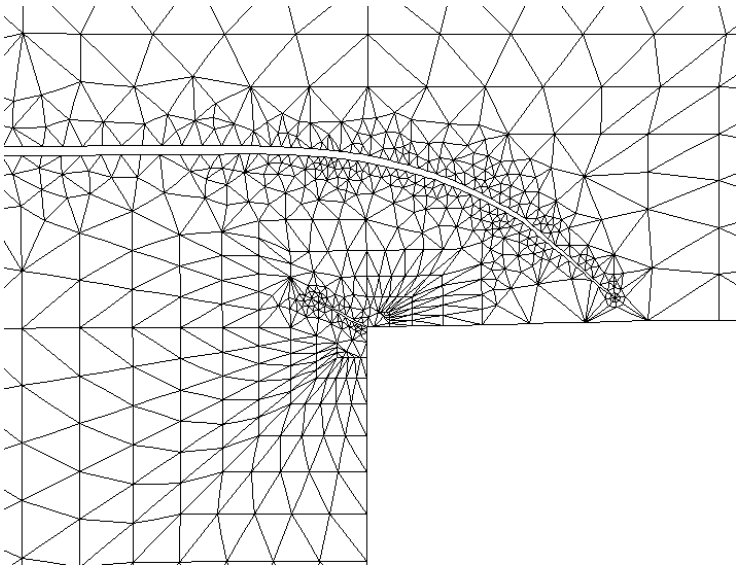
LOADED IN TENSION



CRACK PROPAGATION OF A PMMA T-STRUCTURE SPECIMEN

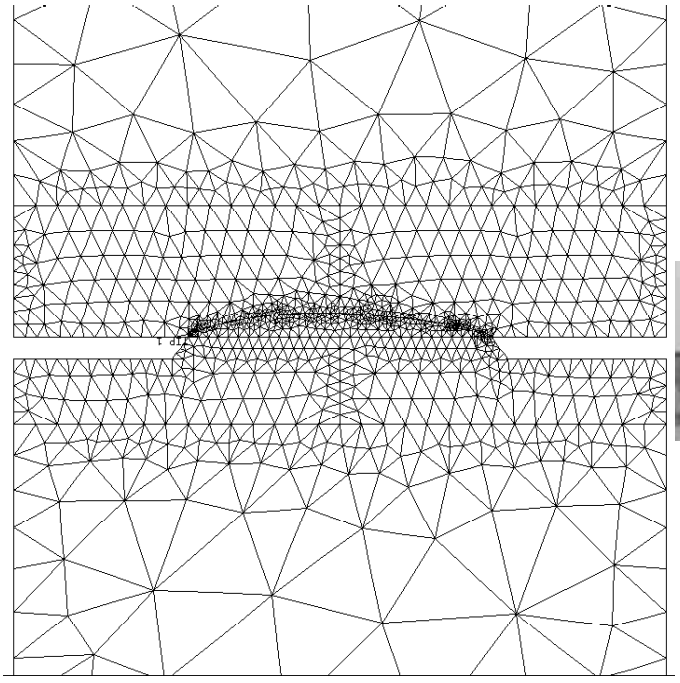
LOADED IN TENSION

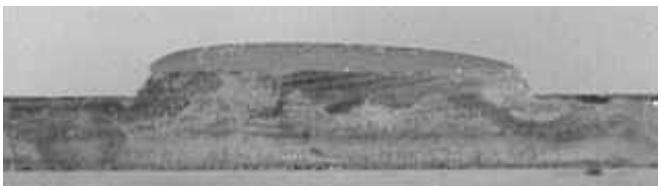




CRACK KINKING AND PROPAGATION IN A SILICON/GLASS

MICRO ACCELEROMETER PACKAGE





WHAT NOT TO DO