Overview
Where the Course Fits (1)

Definitions of Mechanics in dictionaries usually state two flavors:

1. The branch of Physics that studies the effect of forces and energy on physical bodies

2. The practical application of that science to the design, construction and operation of material systems or devices, such as machines, vehicles or structures

Those are traditional definitions: one is science oriented, the other is engineering oriented.

For our purposes we will expand to four flavors.
Where the Course Fits (2)

Four major flavors of Mechanics:

- Theoretical
- Applied
- Computational
- Experimental
Where the Course Fits (3)

Computational Mechanics is subdivided according to physical scale as well as types of matter considered:

- Nanomechanics
- Micromechanics
- Continuum Mechanics
- Solids and Structures
  - Fluids
  - Multiphysics
- Systems
Continuum Mechanics may be also subdivided as to whether inertial (and possibly damping) effects are considered in the mathematical model:

Continuum Mechanics \{ Statics \{ Time Invariant
Quasi-static
\}
Dynamics
\}
Where the Course Fits (5)

A subdivision of Statics is based on whether mathematical models are linear or not:

\[
\text{Statics} \begin{cases} 
\text{Linear} \\
\text{Nonlinear}
\end{cases}
\]
Where the Course Fits (6)

A final subdivision of Computational Solid and Structural Mechanics is based on the space discretization method:

- Computational Solid and Structural Mechanics
- Spatial discretization

- **Finite Element Method (FEM)**
- **Boundary Element Method (BEM)**
- **Finite Difference Method (FDM)**
- **Finite Volume Method (FVM)**
- **Spectral Method**
- **Mesh-Free Method**
FEM Variants

FEM Formulation
- Displacement
- Equilibrium
- Mixed
- Hybrid

FEM Solution
- Stiffness
- Flexibility
- Mixed (aka Combined)
Course Topic (Finally)

Putting all previous classifications together we end up with the following one-sentence description:

The continuum-model-based simulation of nonlinear static structures discretized by FEM

Of the various variants of FEM, we will use the Displacement Formulation combined with the Stiffness Solution. Together these form the Direct Stiffness Method or DSM