

## Discs and bearings

3<sup>rd</sup> step: Adding discs and bearings to the 3D bending beam

### \* User input:

- define beam material & geometry
- define rigid disc
  - position
  - thickness
  - diameter
  - density
- define flexible bearing
  - position
  - rotational stiffness
  - translational stiffness

### \* Element matrices & Global matrices assembly:

same as for 3D beam

### \* Discs & bearings in system matrices:

#### → Discs in mass matrix:

- translational mass added to the correct node in mass matrix ( $u_y$  &  $u_z$ )
- mass moment of inertia added to the correct node in mass matrix ( $\theta_y$  &  $\theta_z$ )

#### → Bearings in stiffness matrix:

- translational stiffness added to the correct node in stiffness matrix ( $u_y$  &  $u_z$ )
- rotational stiffness added to the correct node in stiffness matrix ( $\theta_y$  &  $\theta_z$ )

### \* BCs + Eigenvalue problem:

same as for 3D beam

### ⇒ Results:

- \* Discs increase the beam's mass & inertia locally  $\Rightarrow$  lower natural frequencies
- \* Bearings add localized stiffness  $\Rightarrow$  can increase natural frequencies depending on stiffness values
- \* Disc position: near center  $\Rightarrow$  biggest frequency drop