EK2360 – Introduction to COMSOL Multiphysics - Tasks

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1 Guided tutorial: Simulation of simple cantilever (2D) and calculation of spring constant

- will be demonstrated and explained step by step by the course assistant
- do along with the demonstration of the assistant, interrupt if you can't follow!

2 Tutorial *Computing Capacitance* from the AC/DC Module Model Library

- follow the instructions from the pdf `Task2_models.acdc.capacitor_dc`.

3 Calculation of electrostatic force for parallel plate capacitor (2D)

- Model a parallel plate capacitor with the following parameters:

Space Dimension	2D
Physics	Electrostatics (Es)
Study	Stationary
Plate parameters	
length	300 µm
height	5 µm
width	30 µm
gap	10 µm
act_voltage	60 V
material between plates	air

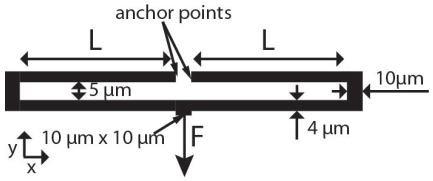
  Do not forget to use a sufficient *air box* around the capacitor. Make sure that the mesh between the plates is sufficiently fine.

- or use the provided model `Task3_ParallelPlateCapacitor_2D_es_FT`
- Calculate the force between the plates. Consult the document `calculation_of_electrostatic_force` for help. Compare result to textbook formula.

4 (optional) Simulation of a simple folded spring (2D)

- Model a folded spring with the following dimensions. Use Global parameters for the length of the beams (L) and the force (F).

Space Dimension	2D
Physics	Solid Mechanics (solid)
Study	Stationary
Spring parameters	
L	$\{200, 300, 400\}$µm
F	20 µN
material	Poly-Si
out-of-plane dimension (z-direction)	30 µm



- Use a parametric sweep to simulate the displacement for different beam lengths. The displacement can be obtained as a `Derived Value`. Also plot the displacement in a 2D plot.
- Calculate the spring constants in x and y direction. Compare result(s) to textbook formula.

5 (optional) Calculation of the electrostatic force of a comb-drive actuator

- Use the provided model `Task5_comb_drive` of a comb-drive actuator and calculate the electrostatic force for different gap sizes (global parameter: `overlap`). Consult the document `calculation_of_electrostatic_force` for help.

6 (optional) Tutorial *Electrostatic Actuated Cantilever* from the MEMS Module Model Library

- follow the instructions from the pdf `Task6_optional_models.mems.electrostatically_actuated_cantilever`
- This model uses the Electromechanics interface, which combines solid mechanics and electrostatics with a moving mesh to model the deformation of electrostatically actuated structures. This is a true multiphysics model and more complex than the models in Task 1-3. A multiphysics model combining solid mechanics and electrostatics is not requested for the course.