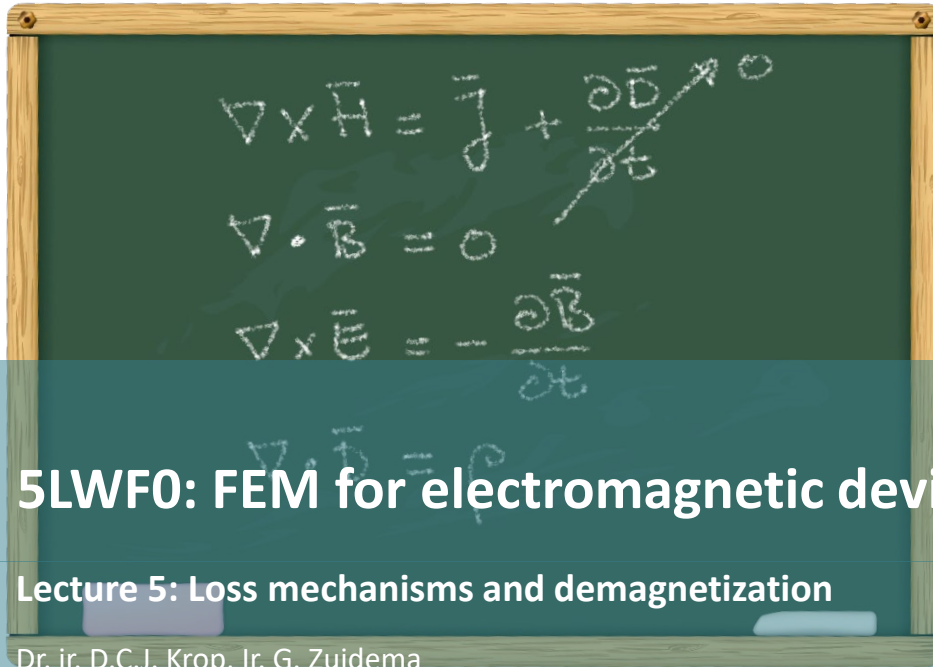
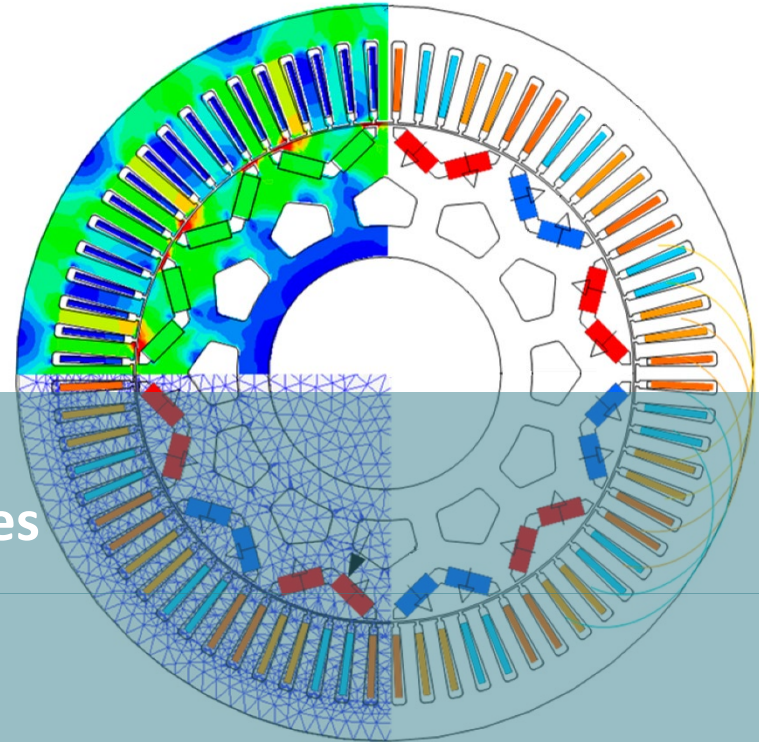




5LWF0: FEM for electromagnetic devices

Lecture 5: Loss mechanisms and demagnetization

Dr. ir. D.C.J. Krop, Ir. G. Zuidema
22 June 2026

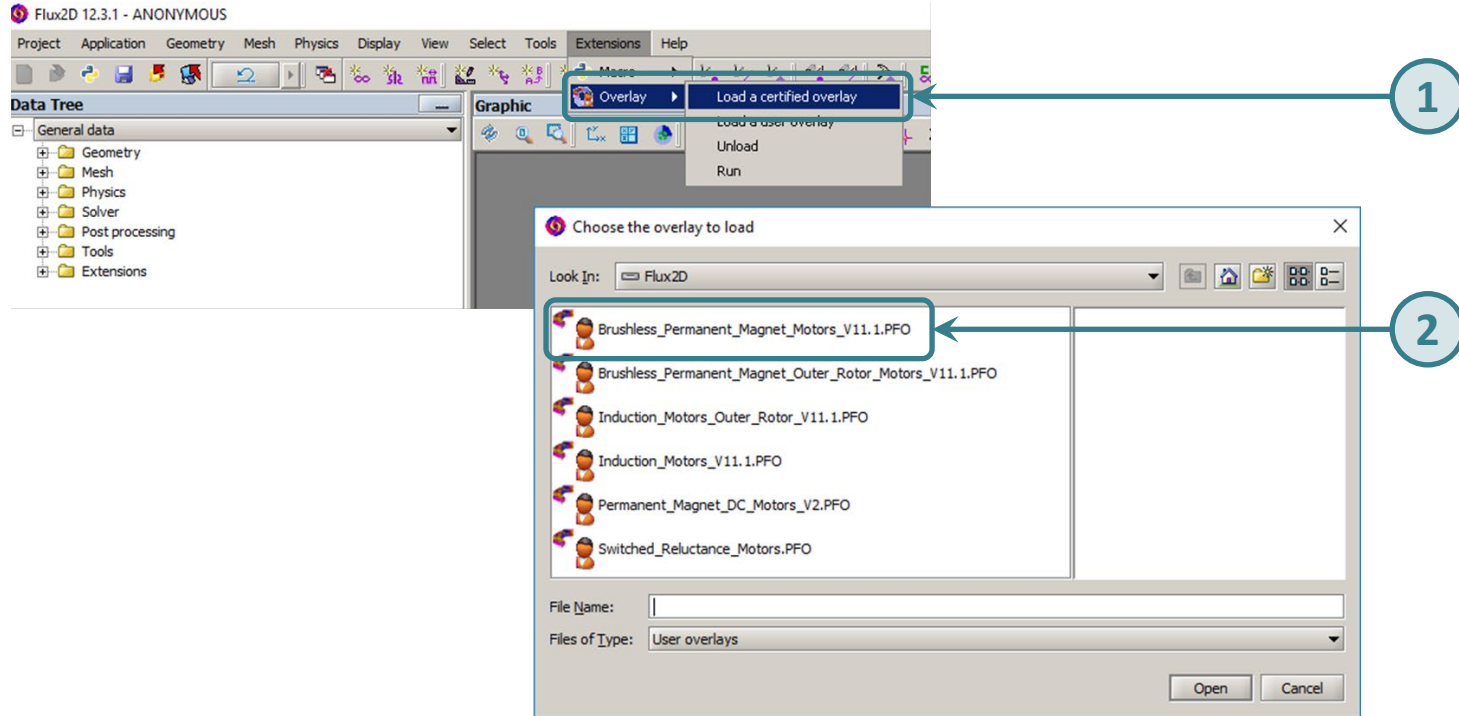


Complex realistic machine topologies

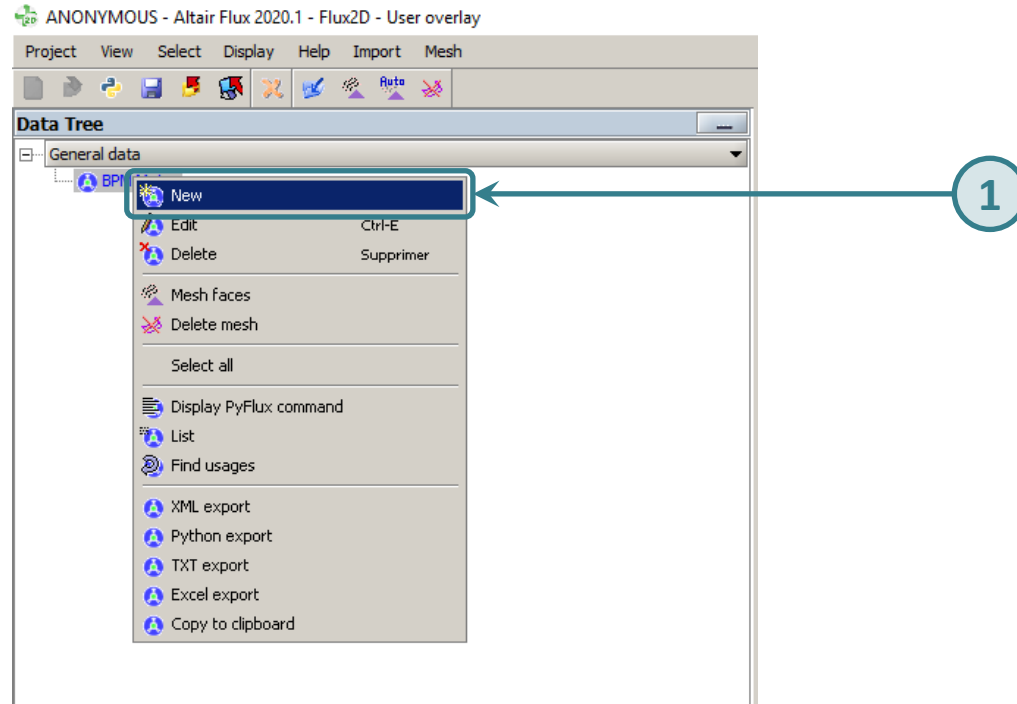
Creating complex machine geometries in FLUX2D using *Overlay*

- Wide variety of conventional rotating machines
 - Inner and outer rotor topologies
- Pre-parameterized models
 - Change to custom parametrization is possible, but **not** recommended
- Model reduction via boundary conditions automatically assigned
- Physics and solution scenario still to be assigned manually
 - Circuit
 - Materials
 - Solver type

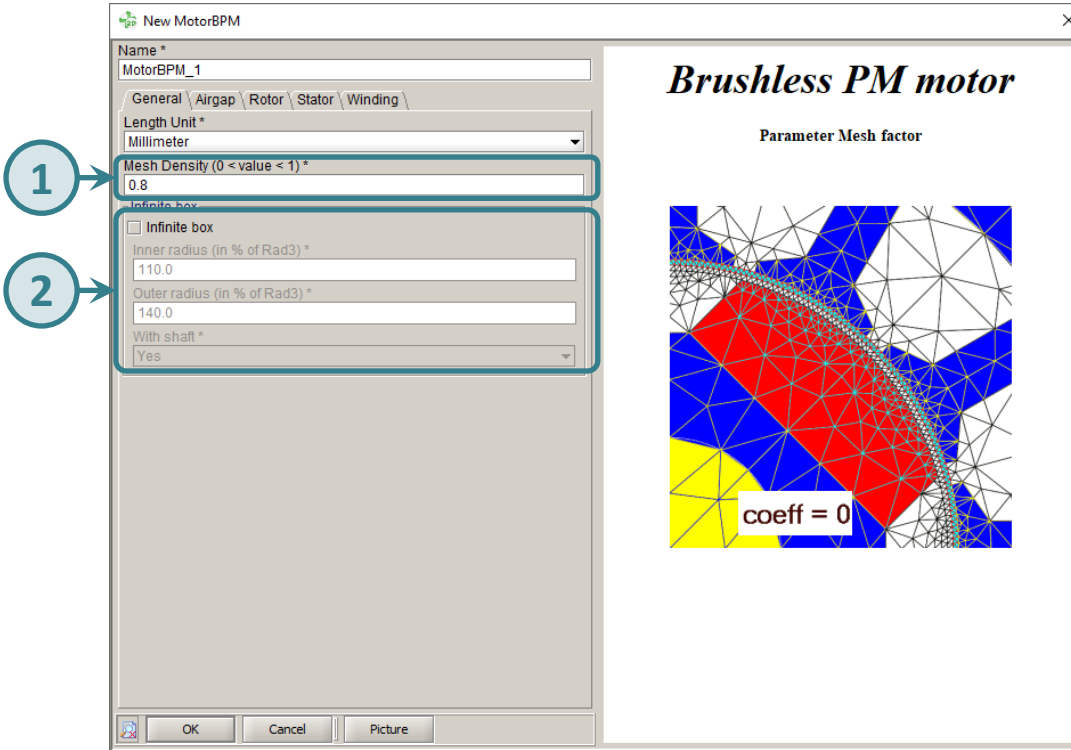
Where to find Overlay in Flux?



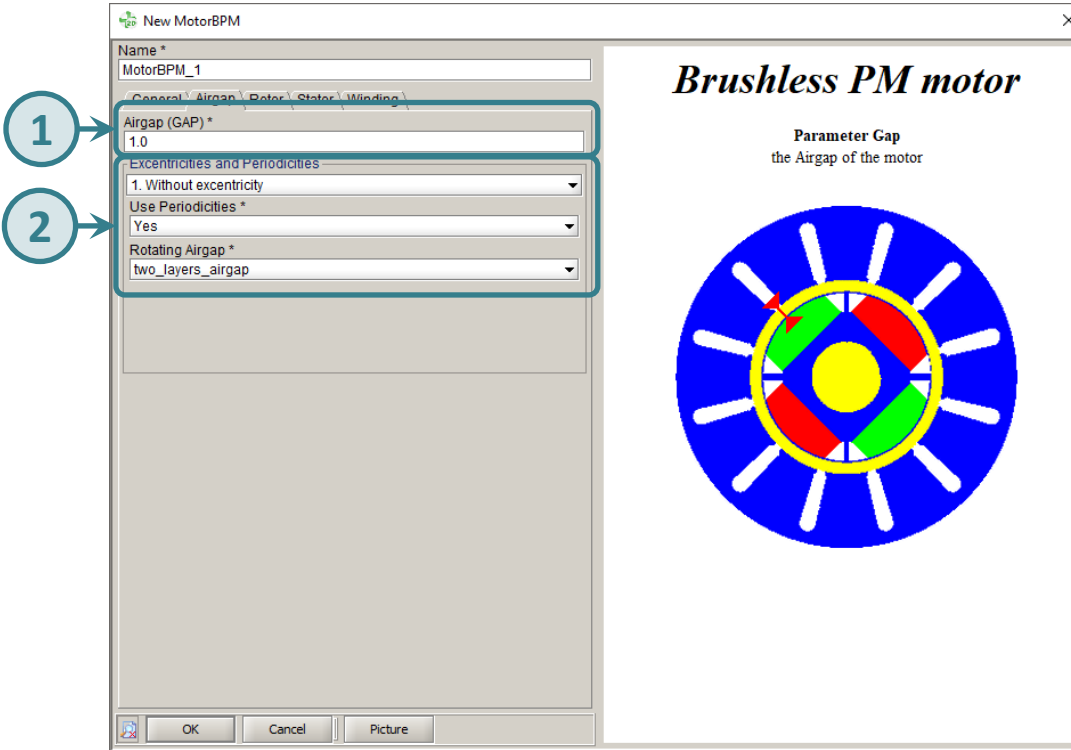
A more detailed model of last week's machine (8-pole)



General tab



Airgap tab



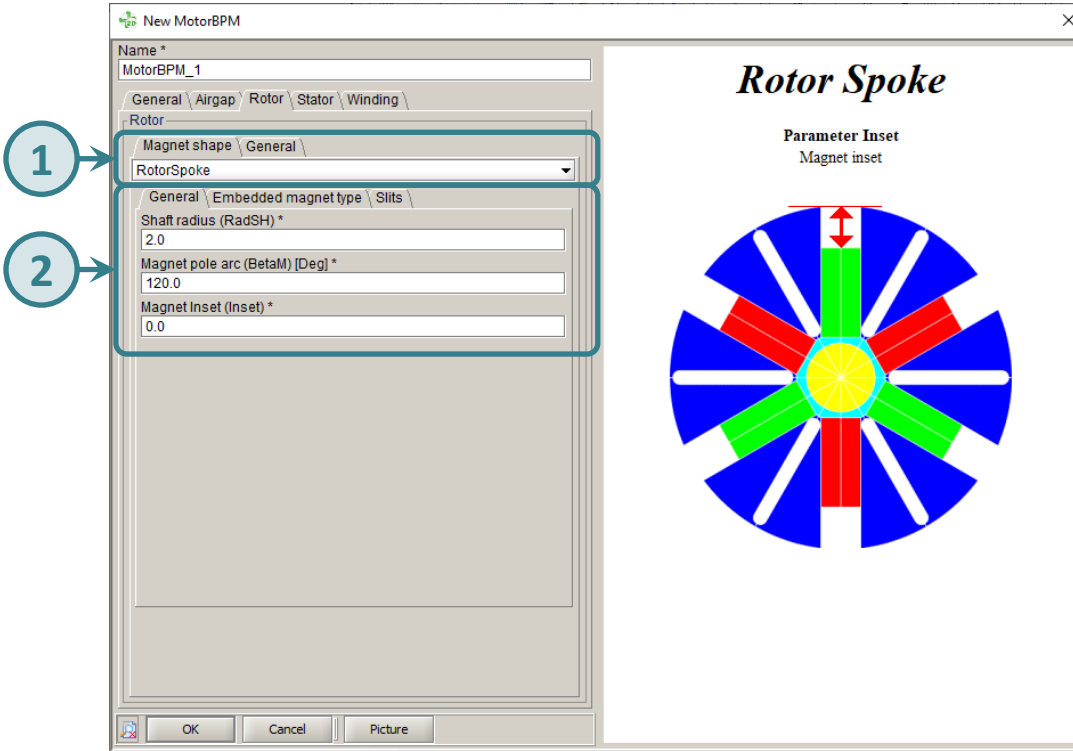
1. Airgap:

- 1.0 [mm]

2. Excentricities & periodicities:

- Without excentricity, i.e. coaxial alignment of stator and rotor
- Yes: reduced periodic model
- Two layers of mesh in the air gap

Rotor tab → Magnet shape



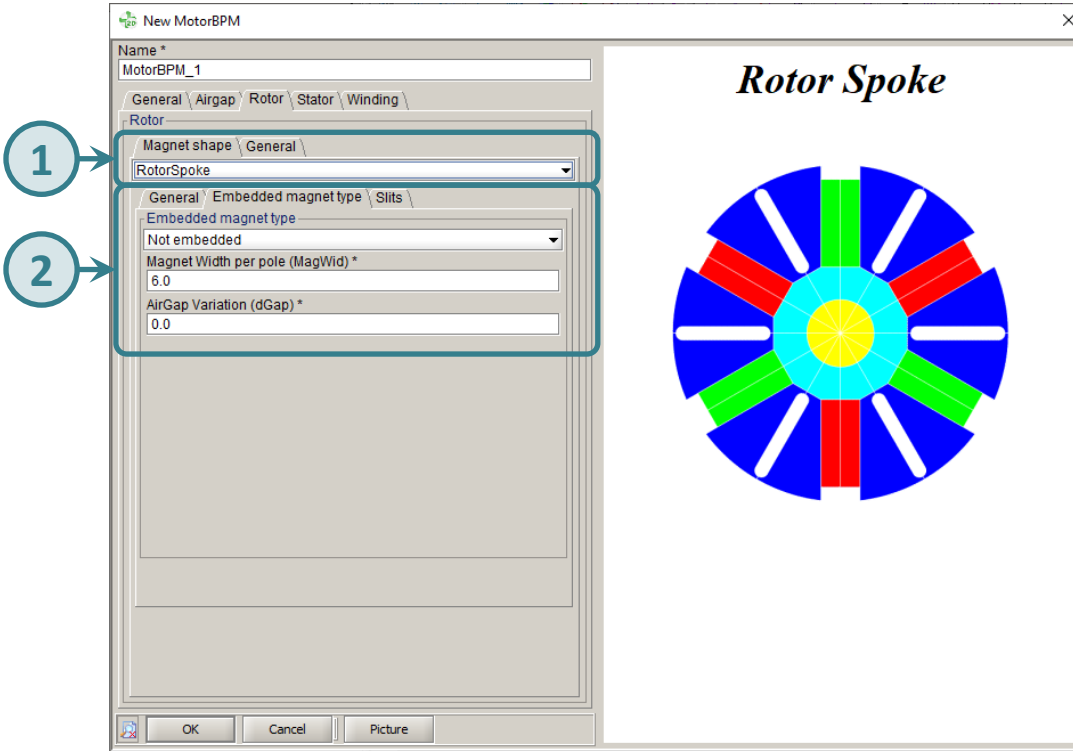
1. Magnet shape:

- RotorSpoke

2. General:

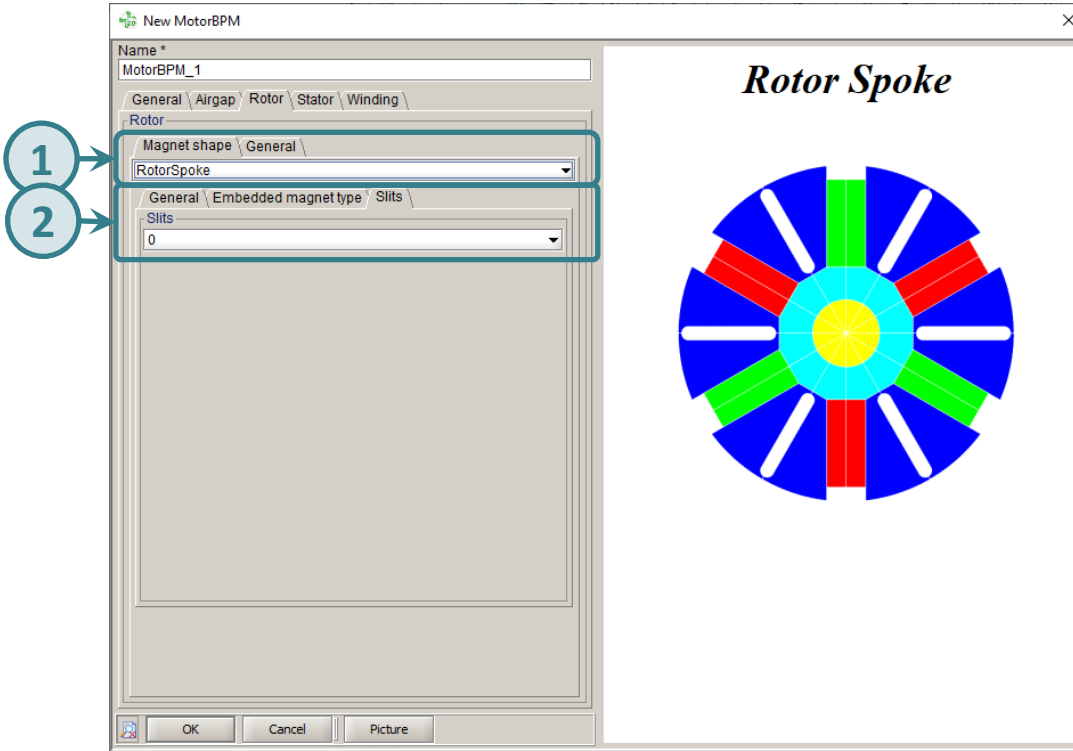
- Shaft radius: 2.0 [mm]
- Magnet pole arc: 120 [° elec.]
- Magnet inset: 0.0 [mm]

Rotor tab → Magnet shape



1. Magnet shape:
 - RotorSpoke
2. Embedded magnet type:
 - Not embedded
 - Magnet width: 6.0 [mm]
 - Air gap variation 0.0 [-]

Rotor tab → Magnet shape



1. Magnet shape:

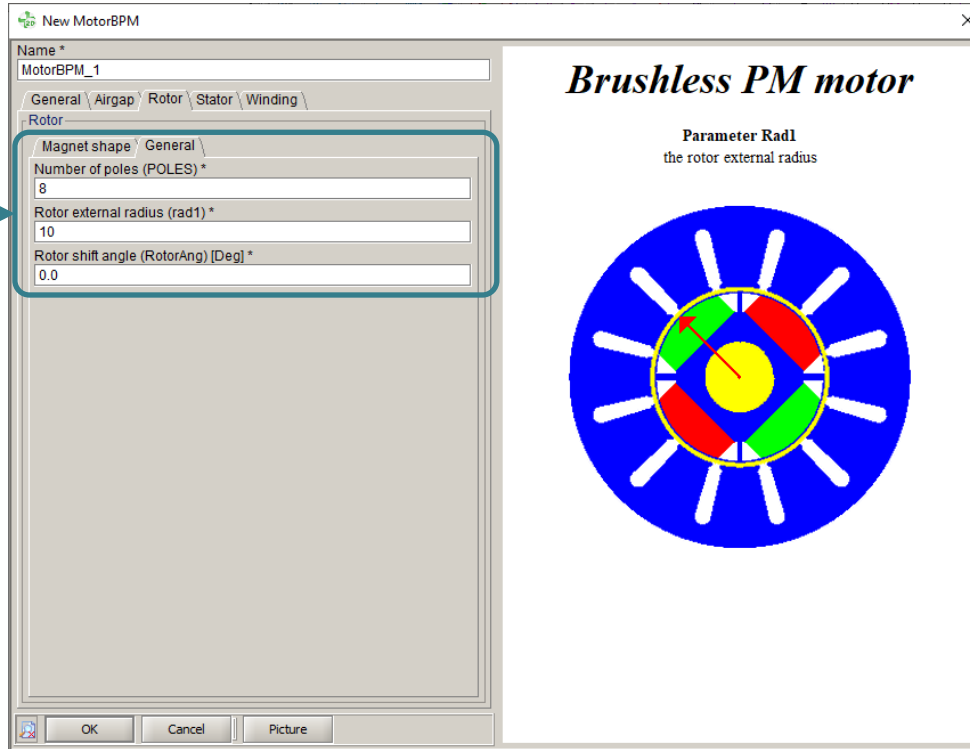
- RotorSpoke

2. Slits:

- Slits:

0 [-]

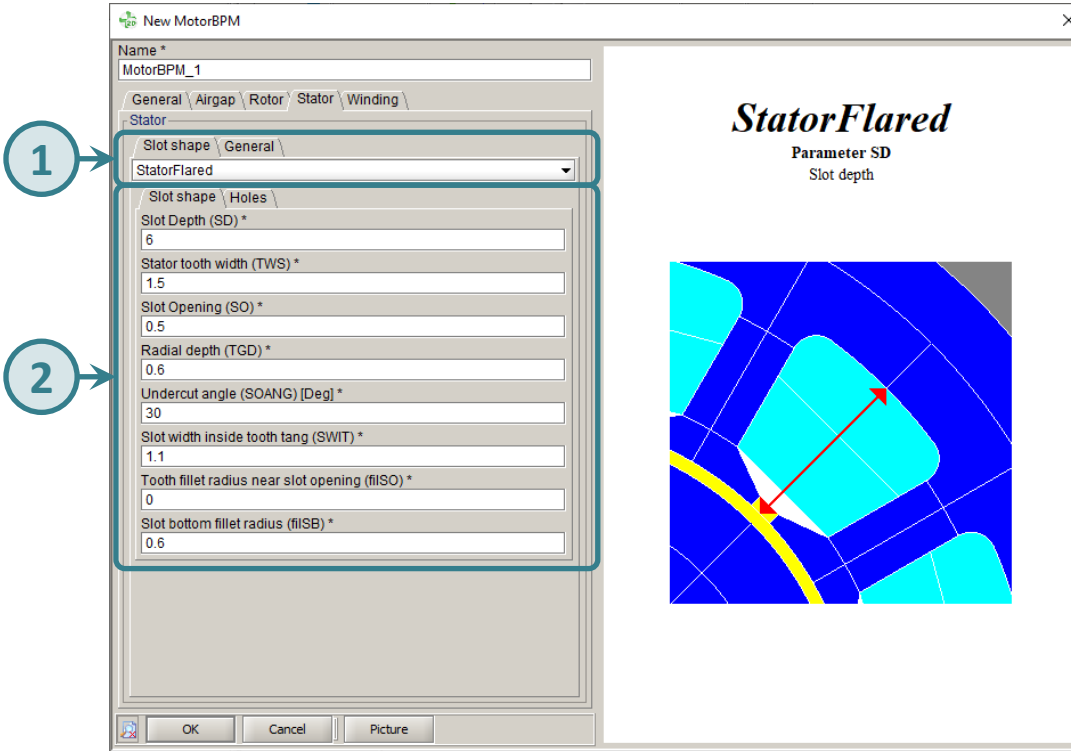
Rotor tab → General



1. General:

- Number of poles: 8 [-]
- Rotor ext. radius: 10 [mm]
- Rotor shift angle 0.0 [°]

Stator tab → Slot shape



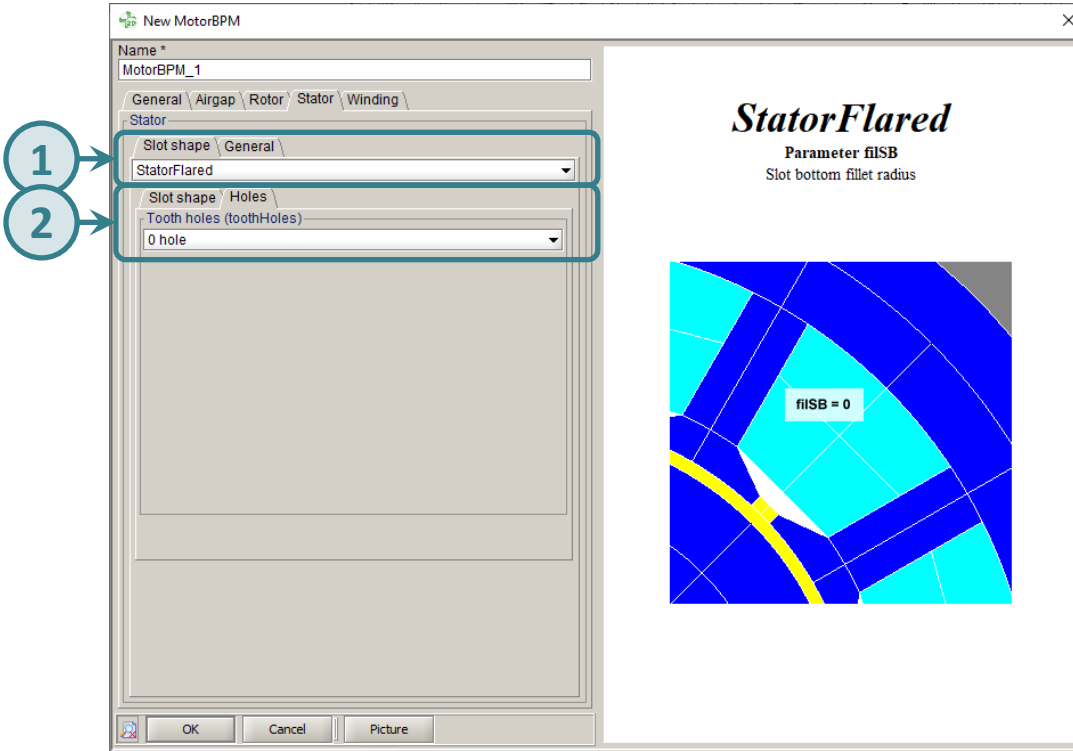
1. Slot shape:

- StatorFlared

2. General:

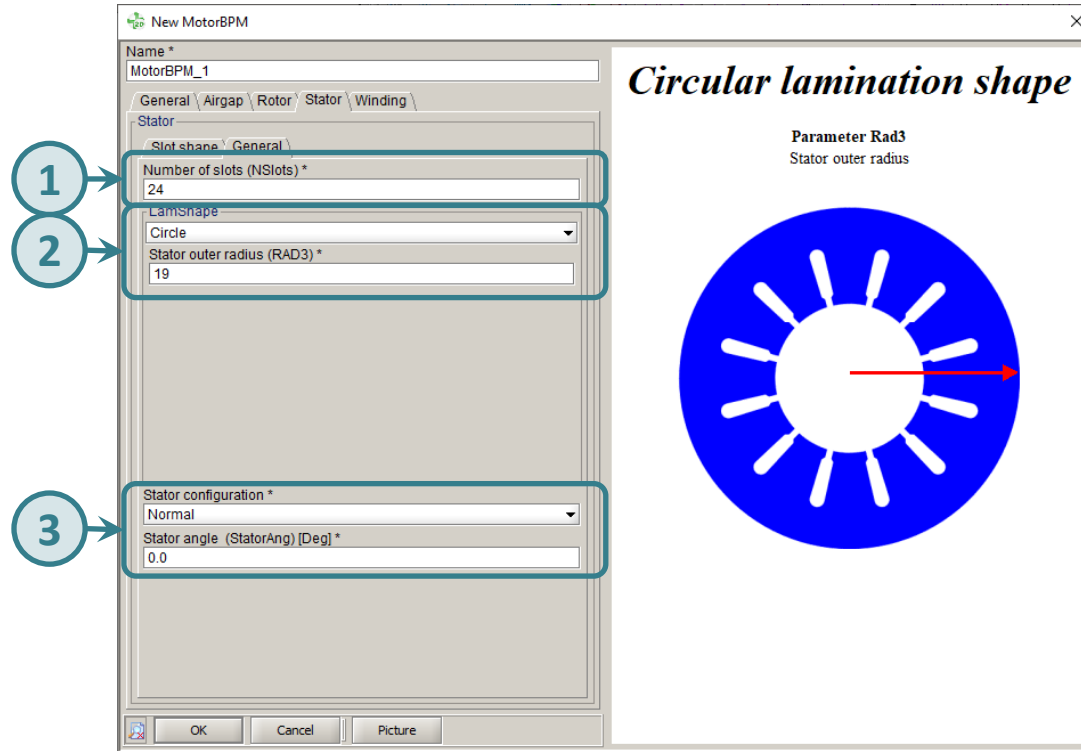
- Slot depth: 6.0 [mm]
- Tooth width: 1.5 [mm]
- Slot opening: 0.5 [mm]
- Radial depth: 0.6 [mm]
- Undercut angle: 30 [°]
- Slot width inside: 1.1 [mm]
- Fillet radius SO: 0.0 [mm]
- Slot bottom Fillet: 0.6 [mm]

Stator tab → Slot shape



1. Slot shape:
 - StatorFlared
2. Holes:
 - 0 hole

Stator tab → Slot shape



1. Number of slots:

- 24

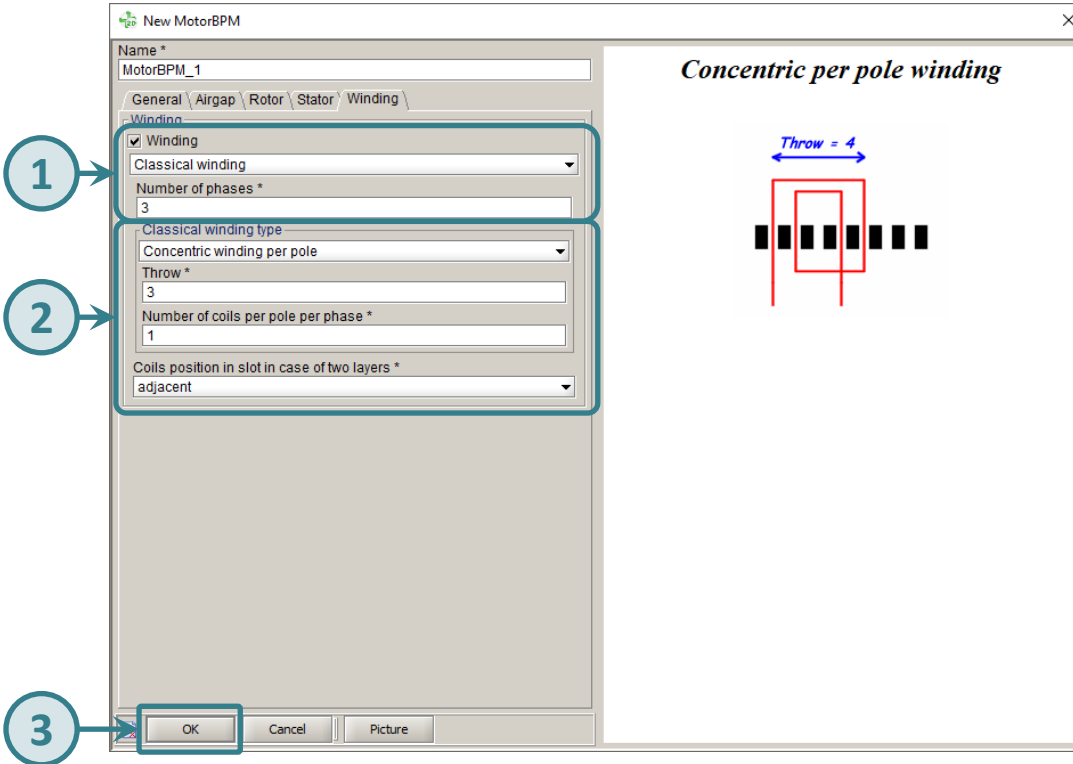
2. LamShape:

- Circle
- Stator outer radius: 19 [mm]

3. Stator configuration:

- Normal
- Stator angle 0.0 [mm]

Winding tab



1. Winding: checked
 - Configuration: Classical
 - Number of phases: 3 [-]
2. Classical winding type:
 - Concentric per pole
 - Throw: 3 [-]
 - Number of coils: 1 [-]
 - Position in slot: Adjacent
3. Click **OK** to create the model

Completing the model

Geometry, mesh and face regions have been created. Complete the model such that:

- The solver is set to transient with a model depth of 100 mm (Choose a proper initialization)
- It is connected to a circuit for no-load analysis including eddy currents in the magnets
- The physics is the same as the simpler 8-pole machine model from week 4
- A no-load EMF and cogging simulation can be performed at a speed of 1000 rpm
 - Vary **BETAM** and **SO** such to find the best compromise between proper AC operation and minimal cogging
 - Next properly dimension the tooth-width and back iron of the stator

Analysis under excitation

- Add current sources to the circuit such that the machine is connected in wye and define the currents to ensure operation on the q -axis