

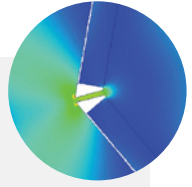
Motor-CAD Mech

2D FEA-based solution in Motor-CAD to analyze stress and displacement in rotors during operation.

Analyze the mechanical stress in rotors using the Motor-CAD Mechanical Model.

Key Features

- Calculates stress and displacement in rotors during operation.
- Optimizes the design of the rotor to maximize electromagnetic performance within the mechanical limits.
- Provides a 2D FE solver with automatic meshing.
- Is intelligent to ensure correct problem configuration.
- Provides very fast solutions — typically within a few seconds.



Workflow

STEP 1 | DEFINE THE MOTOR ROTOR

- Rotor geometry is input using the Mech parameterized template editor, where basic parameters — such as number of poles and inner and outer diameters — can be specified.
- For IPM machines, additional fundamental parameters, such as magnet clearance, flux barriers, magnet posts and rotor bridges, can be adjusted.
- Rotor materials can be chosen from Motor-CAD’s material database or you can specify your own material properties.
- Young’s modulus, density and Poisson’s ratio are defined and utilized in the mechanical stress analysis. The characteristic yield strength and tensile strength can also be input and used as references for future design decision-making.

STEP 2 | DEFINE THE SETTINGS

- With the motor rotor defined, you can adjust the mesh in high-stress regions to get more accurate results. Motor-CAD software’s FEA solver automatically handles boundary conditions and rotor symmetry to speed up the calculation.
- Rotational speed is input and used by the FEA solver to calculate the centrifugal pressure into the rotor structure.
- You can decide to include magnets (BPM) or bars (IM) into the rotor core to evaluate the resulting impact on the rotor mechanical strength.
- For IPM machines, you can soften the contact between the magnets and the rotor to account for the adhesion between the magnet and lamination, to ensure realistic results.

STEP 3 | GENERATE OUTPUTS

- Once the problem is solved, you can visualize FEA results, such as directional displacements and Von-Mises stress distributions, within the rotor radial cross section.
- The Mech output tab displays numerical data calculated from the FEA solution, including averaged Von-Mises stress, maximum Von-Mises stress and safety ratio with respect to the rotor yield strength.
- Motor-CAD has built-in sensitivity analysis to perform a range of what-if analyses on design variants.