# PERMAS

## Rotor Dynamics in V14

<table>
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<tr>
<th>Feature</th>
<th>Co-rotating reference system</th>
<th>Inertial reference system</th>
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<tr>
<td><strong>Elastic rotor</strong></td>
<td>arbitrary shape</td>
<td>axisymmetric</td>
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<tr>
<td><strong>Several rotors</strong></td>
<td>one single speed</td>
<td>different speeds</td>
</tr>
<tr>
<td><strong>Bearing stiffness</strong></td>
<td>isotropic</td>
<td>arbitrary, speed dep.</td>
</tr>
<tr>
<td><strong>Stator</strong></td>
<td>no</td>
<td>arbitrary shape</td>
</tr>
<tr>
<td><strong>Static analysis</strong></td>
<td>subcritical</td>
<td>subcritical</td>
</tr>
<tr>
<td><strong>Dynamic analysis</strong></td>
<td>sub- and overcritical</td>
<td>sub- and overcritical</td>
</tr>
<tr>
<td><strong>Additional matrices</strong></td>
<td>geometric stiffness, centrifugal stiffness, Coriolis matrix</td>
<td>geometric stiffness, convective stiffness, gyroscopic matrix</td>
</tr>
<tr>
<td><strong>Modal damping +</strong></td>
<td>material, viscous</td>
<td>speed dep. bearing, material, viscous in stator</td>
</tr>
<tr>
<td><strong>Campbell diagram in one analysis</strong></td>
<td>with mode tracking and stability evaluation</td>
<td>with mode tracking and stability evaluation</td>
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<tr>
<td><strong>Modal and direct response</strong></td>
<td>harmonic, periodic (steady-state), in time domain</td>
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<td><strong>Sizing and shape optimization</strong></td>
<td>for rotor</td>
<td>for rotor, stator, and bearing</td>
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<td><strong>Active damping</strong></td>
<td>of rotor</td>
<td>of stator and bearing</td>
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<td><strong>Model reduction</strong></td>
<td>of rotor</td>
<td>of rotor and stator</td>
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</table>

This FE model was created using the geometry from [http://grabcad.com/library/2-inch-diameter-3-stage-axial-jet-engine](http://grabcad.com/library/2-inch-diameter-3-stage-axial-jet-engine)
Simplified rotor model of a gas turbine


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Strain energy distribution

Damping ratio

Orbit plot of complex modes

Frequency response due to unbalances

Speed-dependent bearing coefficients

Campbell diagram

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Literature G. Creci et al.