Modeling and analysis of the rotor with the pendulum support

DYNAMICS R4

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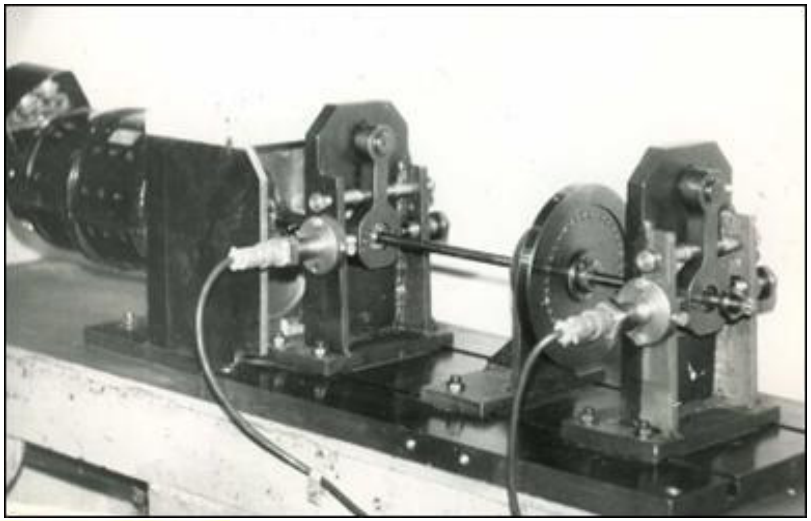
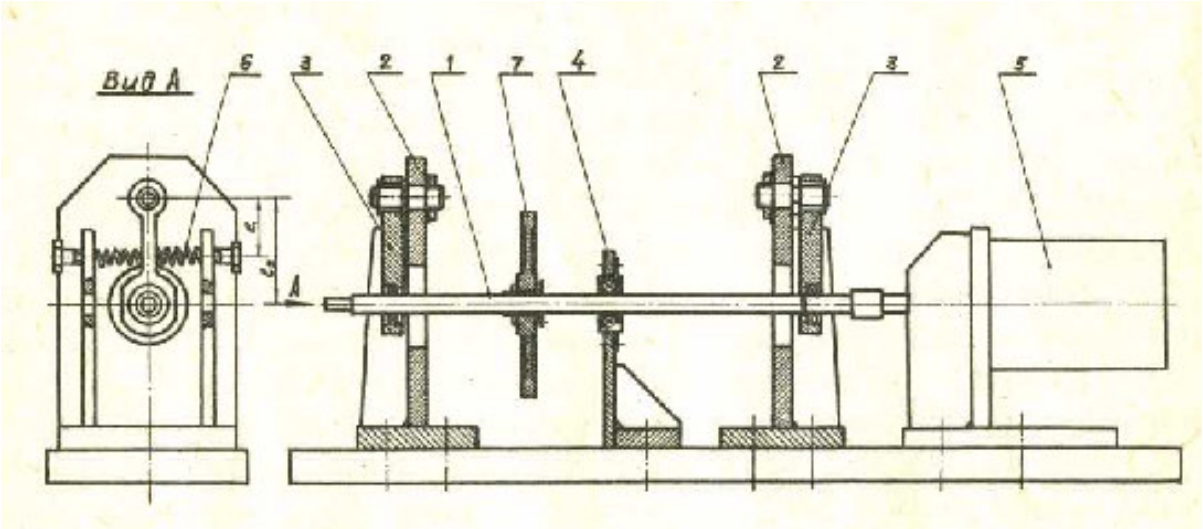
Laboratory plant

Laboratory plant was created to analyze dynamics of rotor on anisotropic (pendulum supports) supports (1975 Leontiev M.K.). Rotor system is modeled as uniaxial.
The Dynamics R4(2007 year) software allows creating a complete spatial rotor model with all elements of laboratory plant, calculating natural and critical frequencies, frequency response and showing precession orbits.





1. ***Rotor shaft***
2. ***Rotor supports***
3. ***Pendulum supports***
4. ***Auxiliary bearing***
5. ***Electromotor***
6. ***Stabilization springs***
7. ***Rotor disc***

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Modeling of the spatial rotor system

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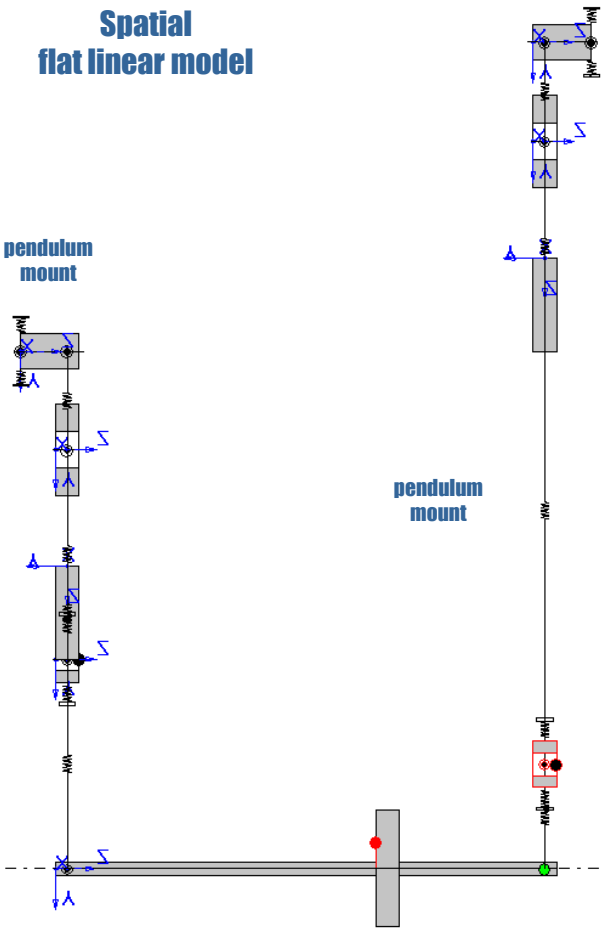
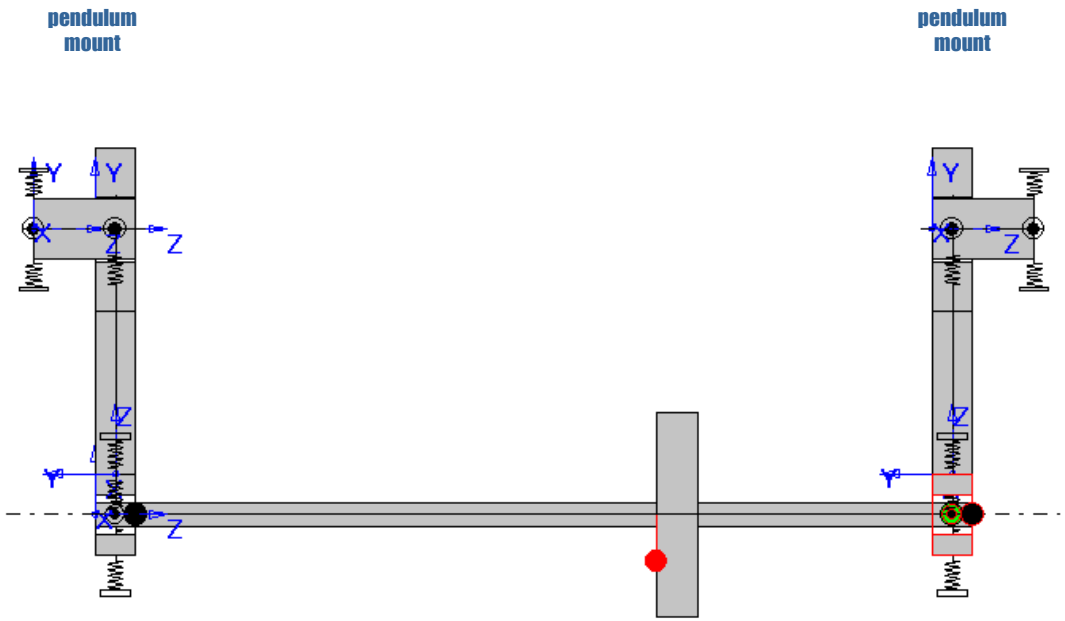
The model consists of several subsystems. Rotor is hanging up on pendulums. In vertical plane of the rotor support stiffness is equal to the rolling bearing stiffness. In horizontal plane for stabilization rotor was mounted springs.

Spatial flat linear model



Assembled flat model



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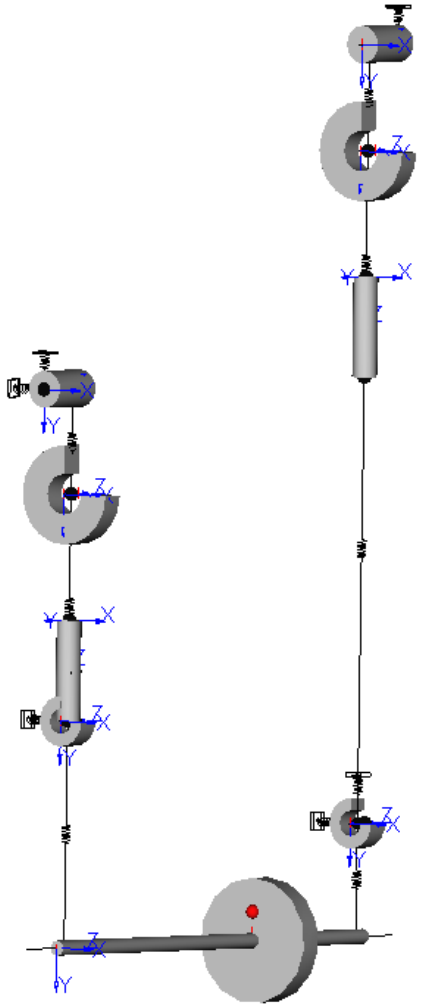
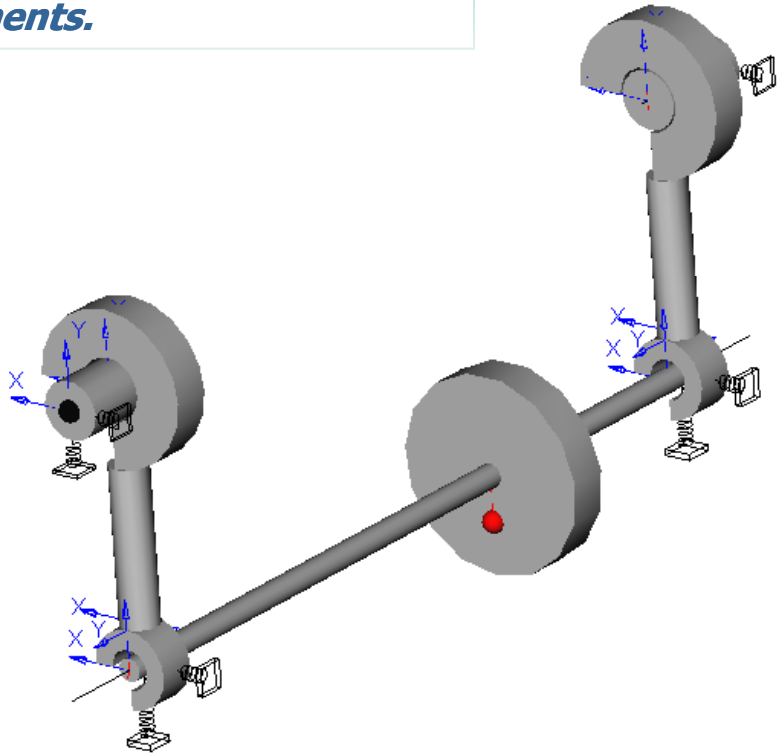
3D- model of the rotor system



Dynamics R4 allows modeling complicated spatial rotor systems of the rods elements.



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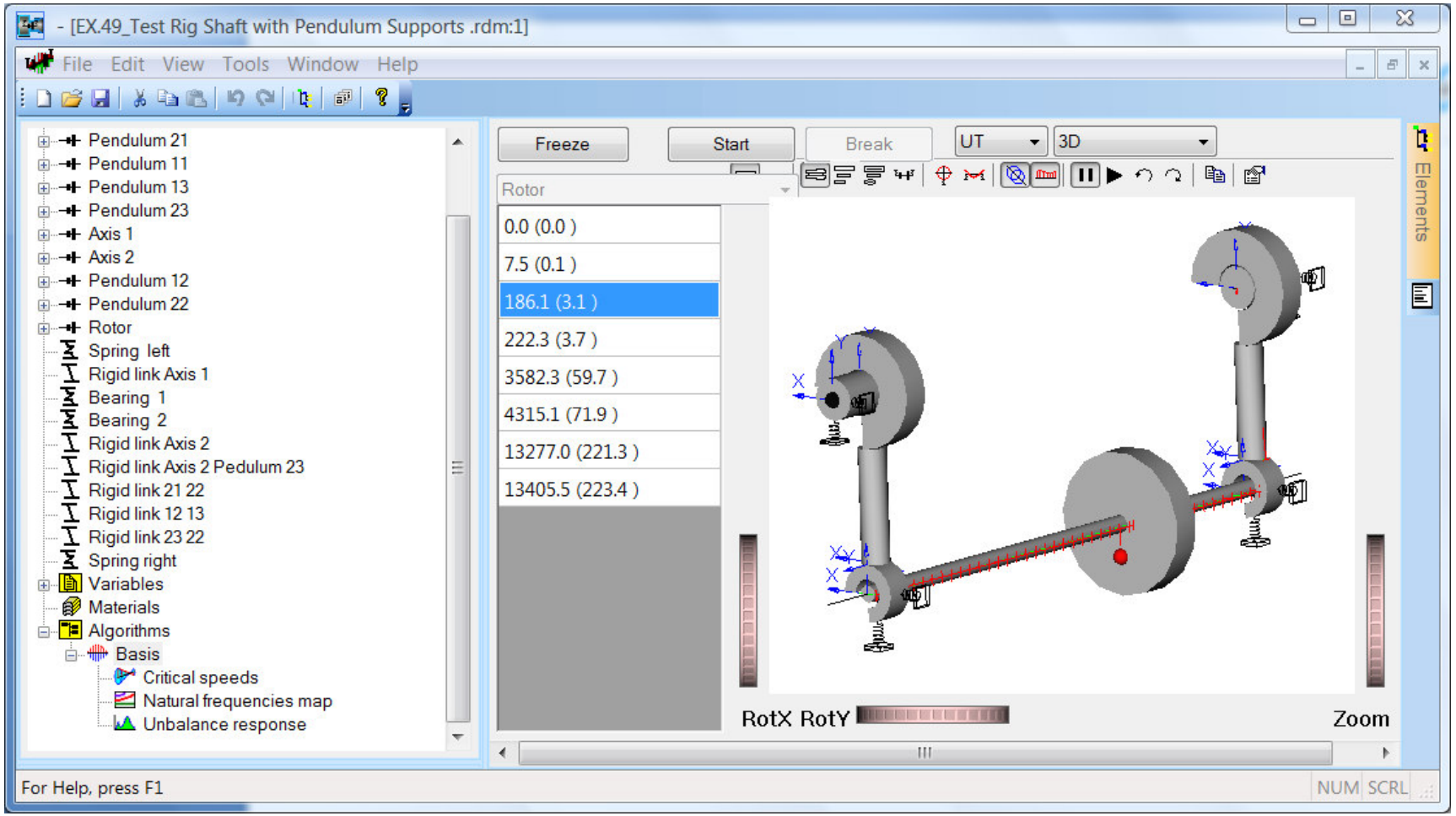
Dynamics R4 main window



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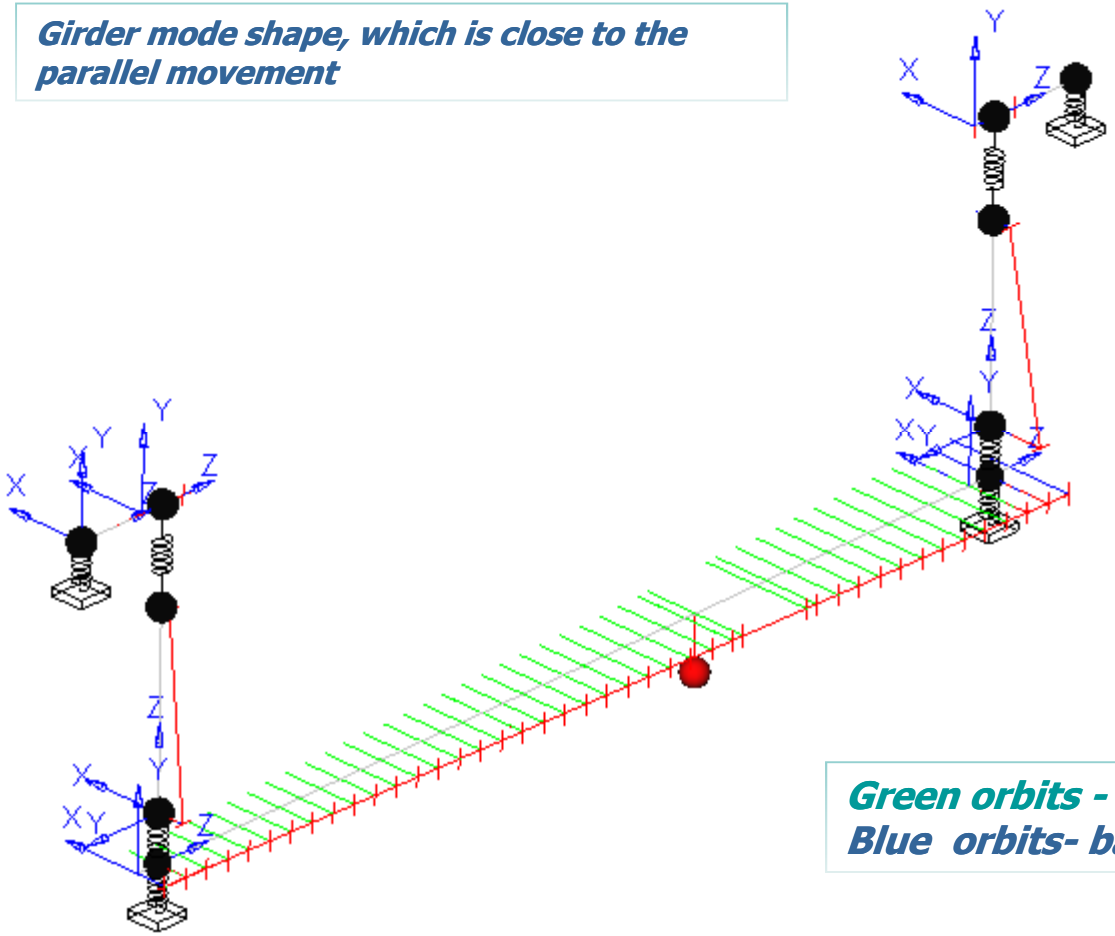
Mode shape 167 rpm

Girder mode shape, which is close to the parallel movement



Rotation and anisotropy of the system leads to the coupling of flexural vibrations in the vertical and horizontal plane. Mode shapes with elliptical sections forward and backward precessional motion. This means that the direct load excites all mode shapes.

Green orbits - forward precession
Blue orbits- backward precession

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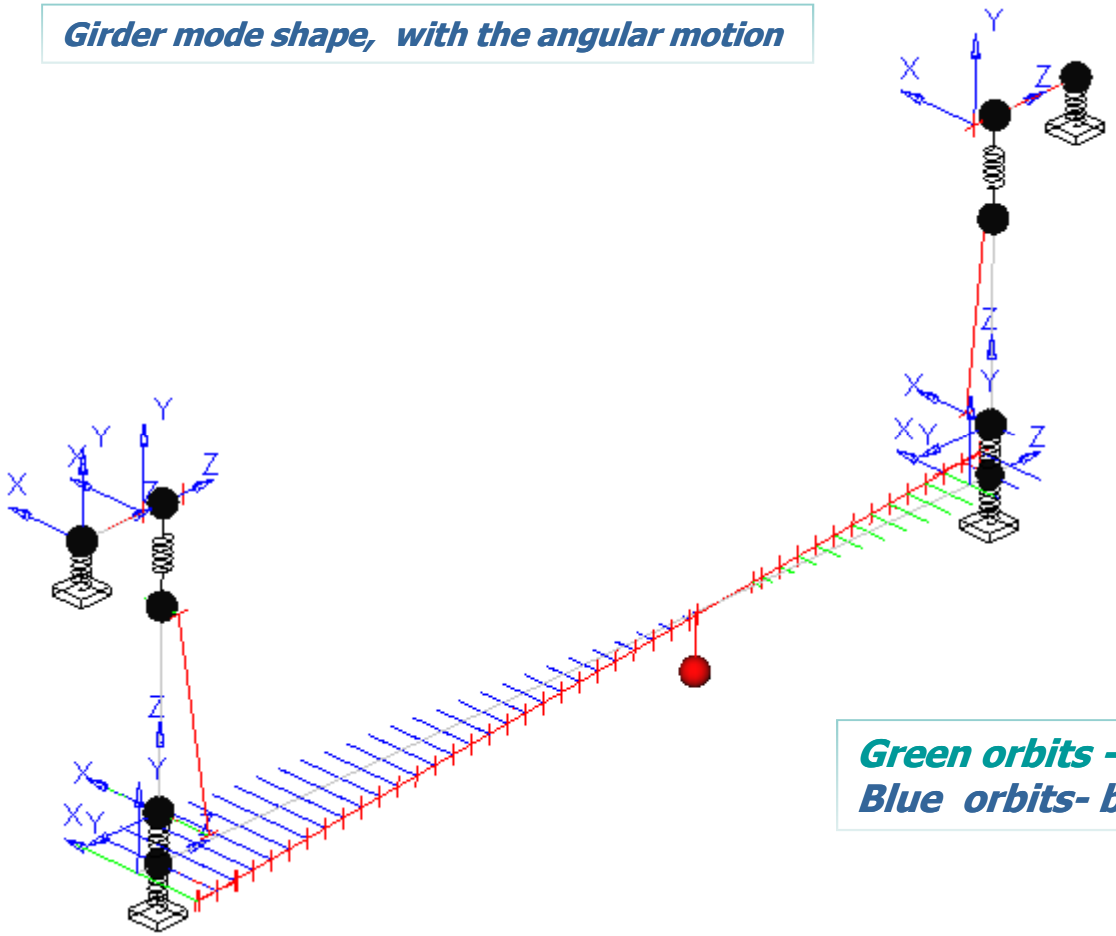
Mode shape 219 rpm

Girder mode shape, with the angular motion



Green orbits - forward precession
Blue orbits- backward precession

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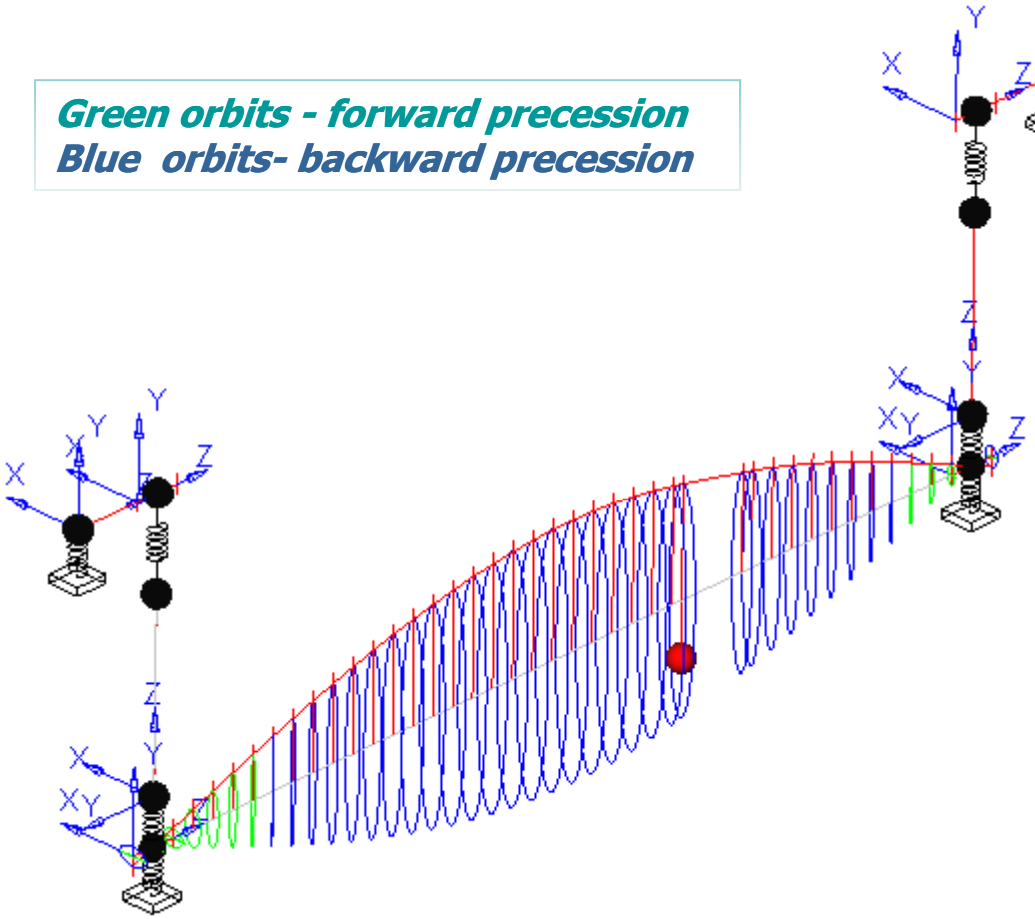
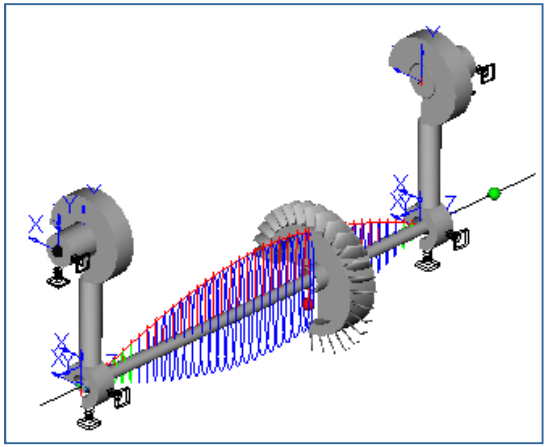
Mode shape 2822 rpm

Green orbits - forward precession
Blue orbits- backward precession





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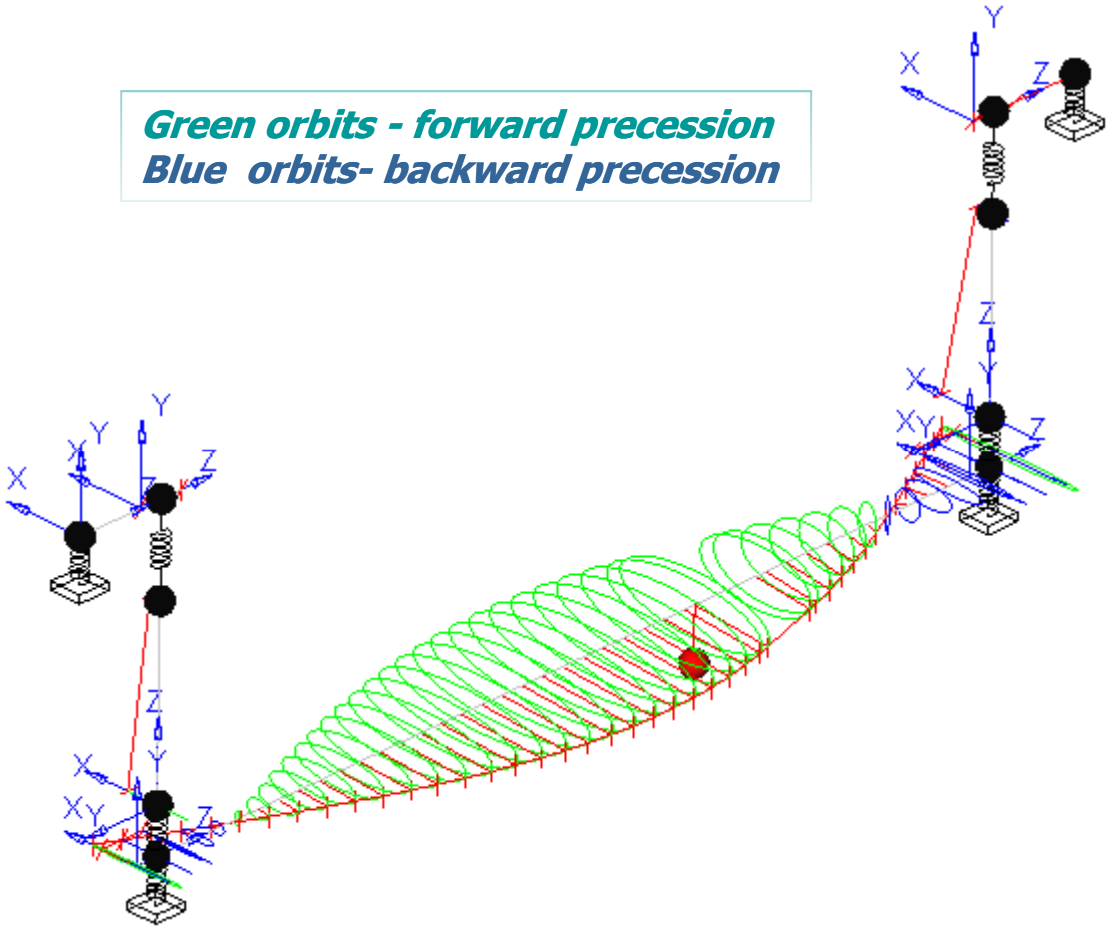
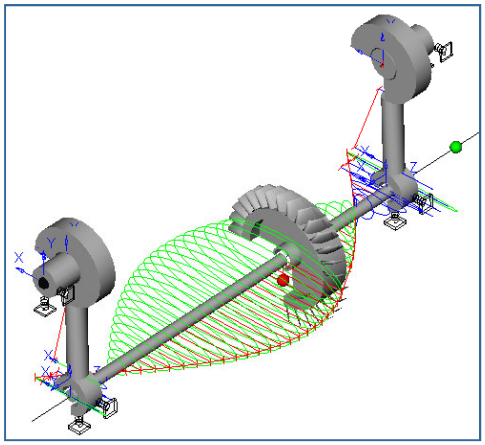
Mode shape 3731 rpm

Green orbits - forward precession
Blue orbits- backward precession





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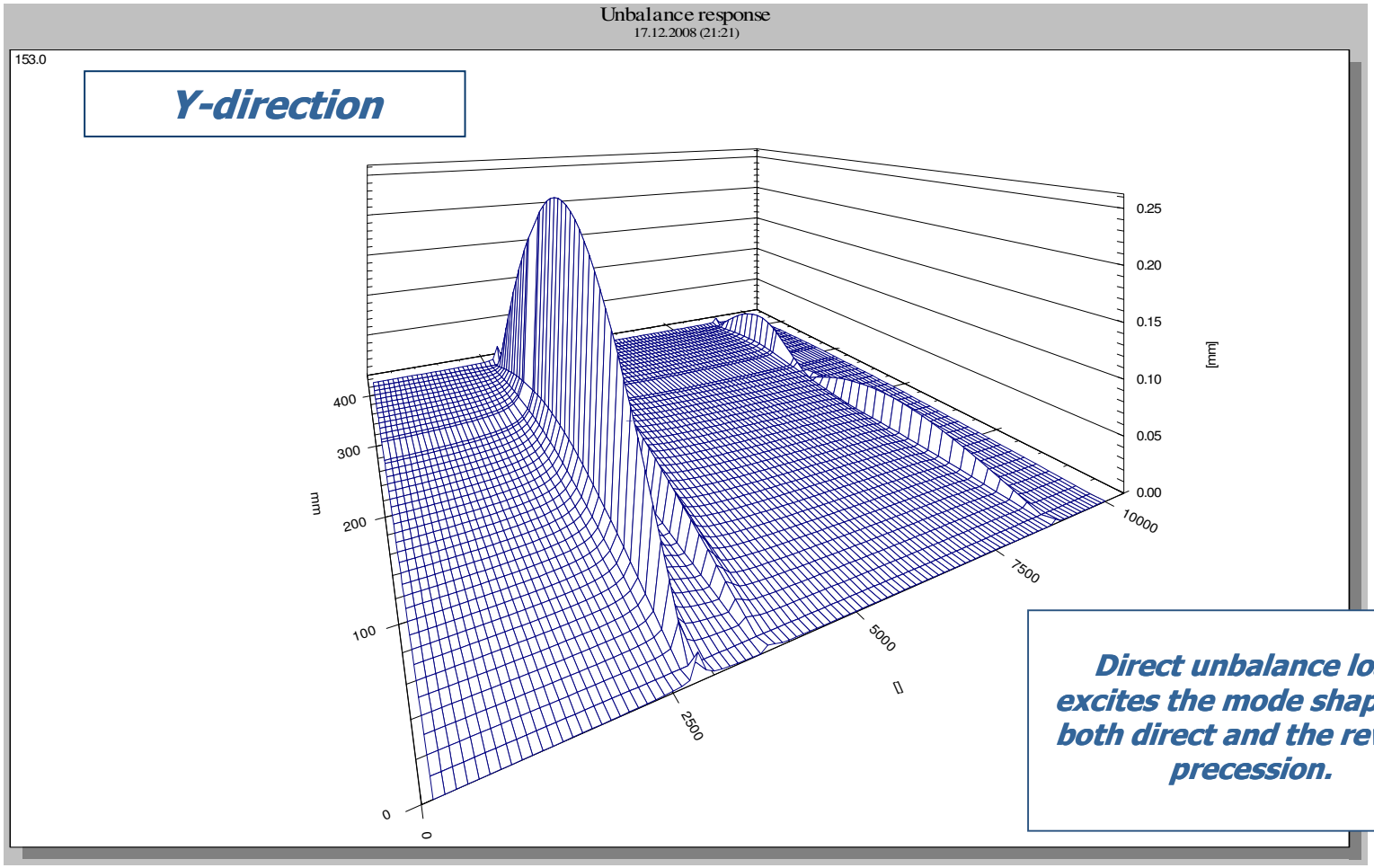
Unbalance response (3D – amplitude-frequency characteristic)



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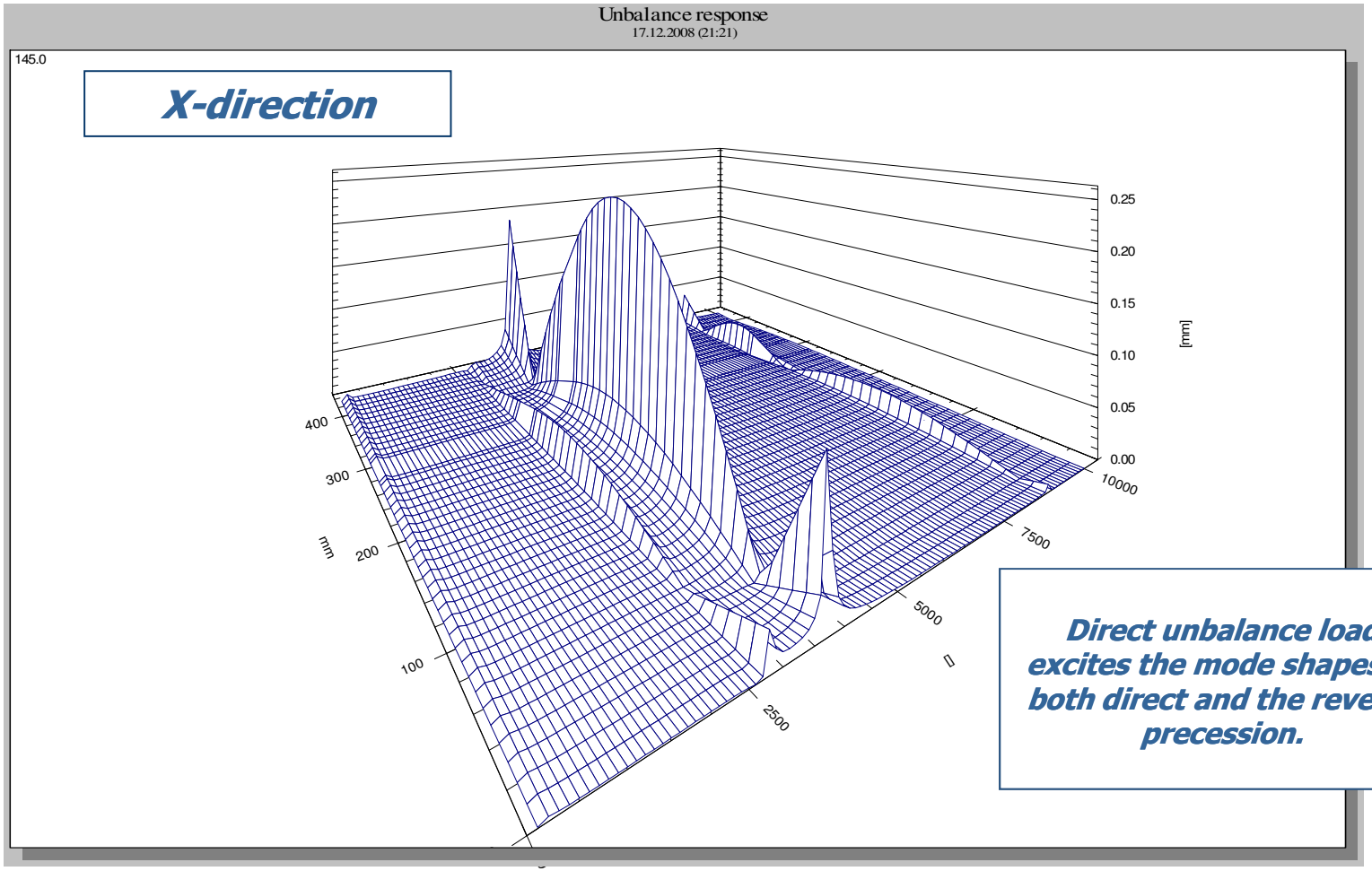
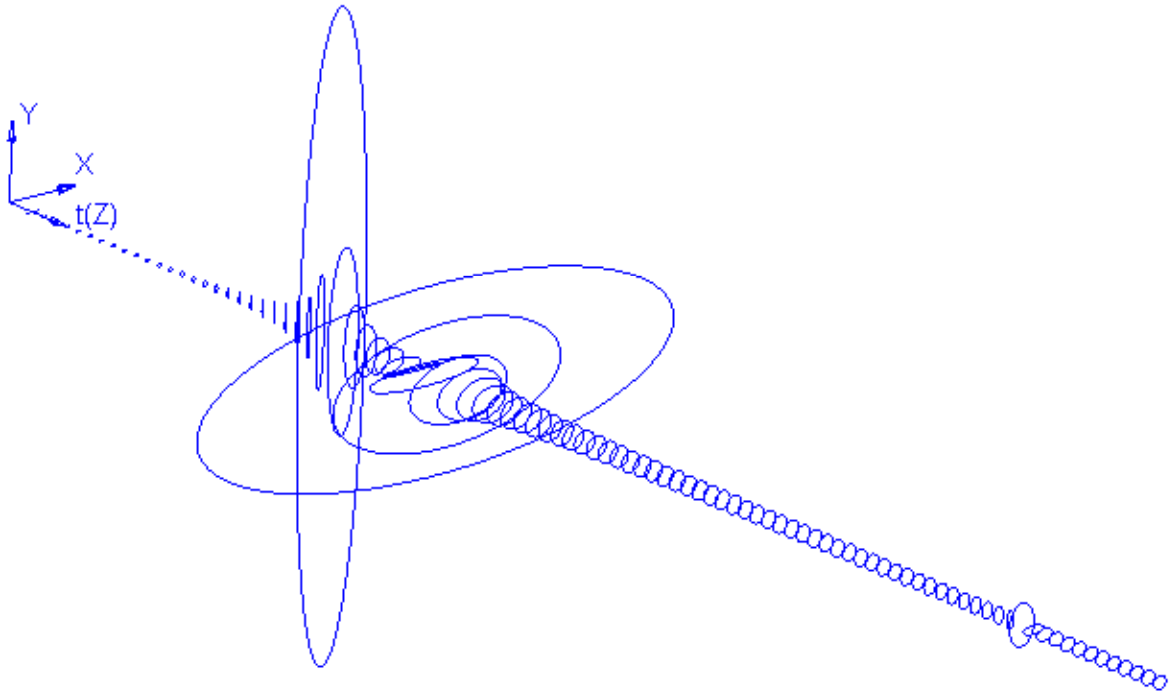


Unbalance response (orbits)

The spatial pattern of the orbital motion in time



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