DELTA JS AG

Machine Dynamics
Engineering * Consulting * Software

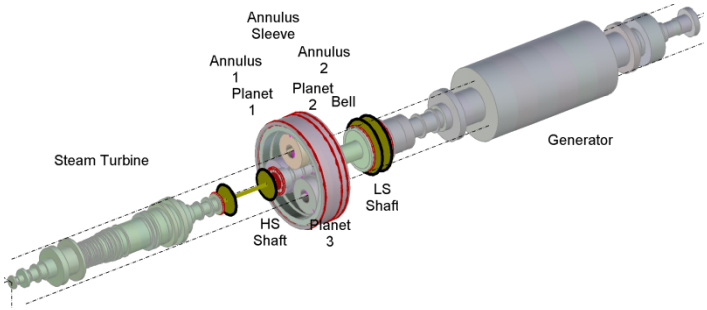
MADYN 2000: Software for General Rotordynamics

Unique Modelling Capabilities

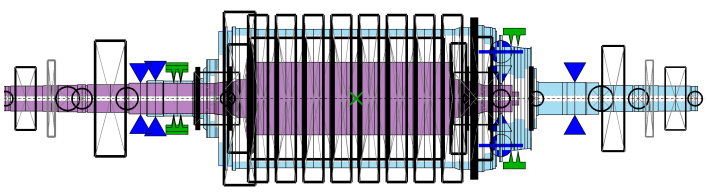
- Rotor gear bearing systems for torsional, lateral, axial and coupled analyses
- Parallel and planetary gears with stationary as well as rotating planet carriers
- Consideration of lateral, torsional and axial coupling in gears
- Bearing types: Spring and damper, linear & nonlinear rolling element bearings, linear & nonlinear fluid film bearings and floating ring bearings, magnetic bearings (radial and axial)
- Rolling element bearings are considered with a 5x5 stiffness matrix taking into account the lateral and rotational stiffness about bending axes and the lateral, axial coupling.
- For fluid film bearings various effects can be considered: 2-phase flow in cavitation zones taking into account ambient pressure, turbulence, different oil supply conditions and axial sealing, thermo-elastic deformation, canting
- Tilting pad bearings with frequency dependent characteristic
- Magnetic bearing controllers can be modelled by proven controller building blocks similar to real systems.
- Bearing supports (casings and foundations): Spring mass damper, coupled transfer functions (couplings between different bearings are considered), state space matrices
- General spring (6x6 full stiffness and damper matrix)
- Flexible couplings with linear and nonlinear characteristics
- Fluids (for seal effects) with speed dependent coefficients
- Elastic mounting of masses with an axial offset to their centre of gravity
- Superimposed shaft sections with different material, e.g. to model motor windings
- Temperature dependent materials
- Import of rotor data from text files via a flexible interface
- Active system for torsion allows modelling linear relations by state space matrices between torsional deflections and velocities and torques
- Mechanisms causing hot spots (e.g. Morton effect)
- For further user specific modelling custom blocks can be defined.
- User defined nonlinearities (apart from the standard nonlinearities for fluid film bearings, rolling element bearings and flexible couplings) can be defined with the help of custom blocks and MATLAB code.

Powerful Analytical Capabilities

- Static analyses: Force, gear, weight loads, misalignment (optional consideration of journal position in fluid films and the deformation in rolling element bearings), alignment optimization for force free coupling
- Damped eigenvalues: Complete systems are considered, e.g. consisting of the rotor, a magnetic bearing system and a stator system (casings and foundations), i.e. no iterative solution for frequency dependent characteristics.
- Harmonic response to unbalance, forces and moments, base acceleration
- Linear and nonlinear transient response to forces and moments, base acceleration
- Linear and nonlinear transient run ups and downs
- Parameter variation (eigenvalues as a function of a parameter): Undamped critical speed map, Campbell diagram (speed variation), bearing stiffness and damping variation, flexible coupling stiffness variation, general parameter variation
- Hot spot stability, among others Morton effect stability
- Optimization of magnetic bearing controller parameters with respect to damping, bearing forces and robustness
- Alignment optimization considering the oil film



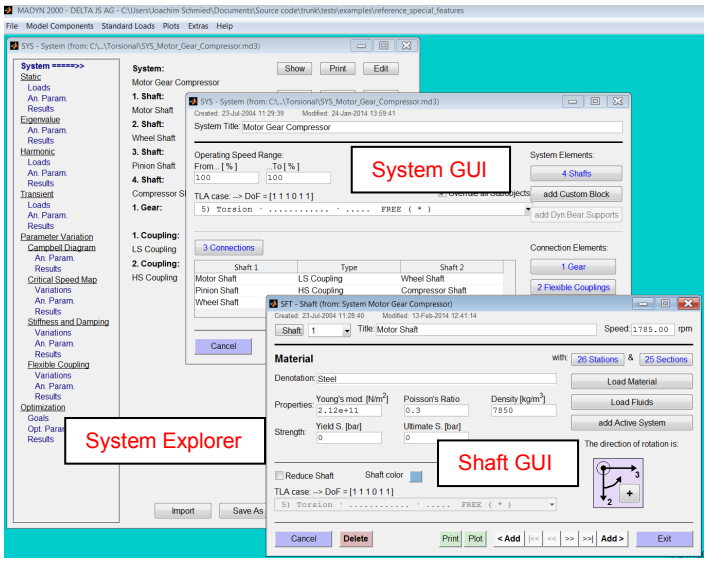
Model of a steam turbine generator train with planetary gear



Model of a pump with inner and outer rotor

Easy to Use Graphical User Interfaces (GUIs)

- to model,
- to apply loads,
- to define and start analyses,
- to select and present results.
- The system explorer allows controlling every step of a rotor dynamic analysis: Modelling, defining loads and analysis parameters, viewing results



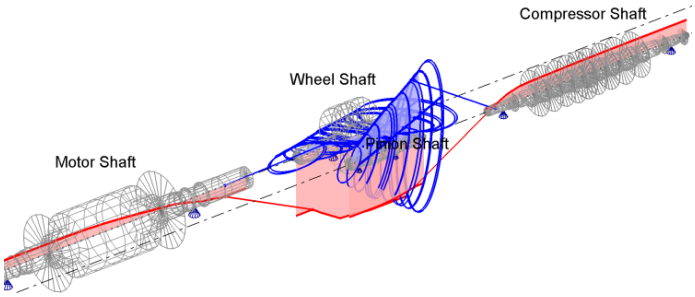
System explorer with graphical user interfaces

Object Oriented Data Structure

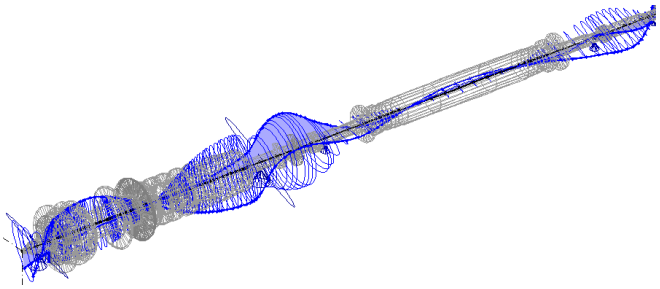
- to have self-contained objects such as bearings, shafts, gears or systems,
- for easy combination and mounting of model parts such as bearings and shafts,
- to simply create libraries by storing objects in appropriate directories.
- Consistent and complete information (model, loads, analysis parameters and results) is stored in a system. Its behaviour is intelligent to maintain consistency, i.e. in case of changes affected results are cleared.

Plots of Models and Results

- Plots are clear and practice oriented with complete and consistent information. Various options for the presentation of very complex information are offered (add data tips, select individual shafts …).
- Curves of diagrams can be copied and pasted for comparison of results between different systems.
- Model plots are available at all hierarchical levels: Systems, gears, shafts, bearings, couplings.
- Shape plots (results along shaft axes) for deformations, forces and moments, stresses
- Clear presentation of time dependent shapes
- Resonance plots with various options (selectable lateral directions, main axis of orbits, relative vibration, API evaluation of resonances for lateral vibrations)
- Presentation of eigenvalues in Campbell diagrams and other diagrams with sophisticated sorting
- Various other diagrams for parameter variation results
- Plots for the time history, orbits and shapes of transient response results
- Plots can be configured by the user.



Coupled lateral torsional vibration mode



Natural mode of a power generation shaft train

Automation of Analyses

- Batch processing files can be created and imported to different systems. The use of denotations for objects allows generalizing loads and analyses parameters for various systems.
- With the help of a command line interface objects can be addressed and their properties changed using WINDOWS scripting.

Services

- A standard training within a general rotor dynamic seminar takes place twice a year. Individual trainings are offered either in DELTA JS or the client's offices.
- Support by e-mail and telephone
- Maintenance with regular updates. Updates include new features and improvements to enhance the user friendliness and robustness.

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