MESYS Rolling Bearing Calculation

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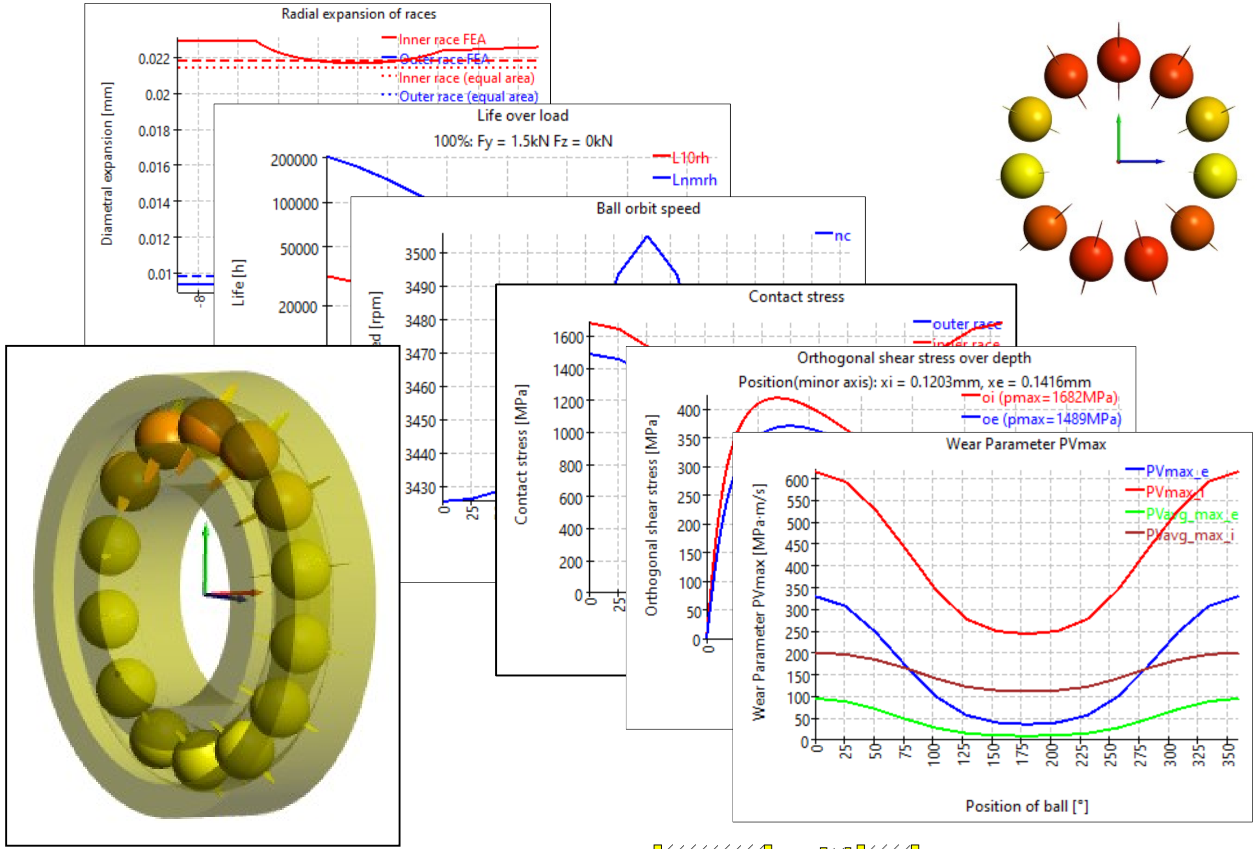
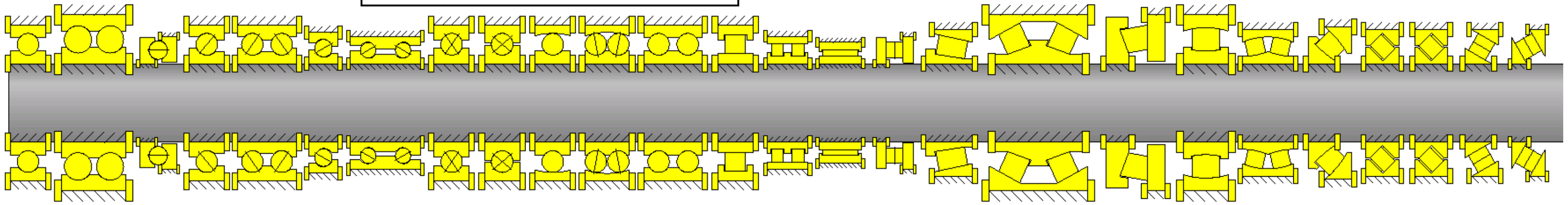


Calculation according to ISO 16281



Bearing life

- **Nominal life according ISO 281**
  The nominal life L10 in million rotations is calculated using dynamic load capacity Cr and dynamic equivalent load P.
- **Modified life according ISO 281**
  The modified life Lnm is calculated from nominal life using the factors a1 and aISO. These factors take into account reliability, lubrication and cleanness.
- **Nominal Reference-Life according ISO 16281**
  The reference life L10r is calculated from load distribution within the bearing and dynamic load capacity. Considering the load distribution in the bearing clearance and tilting angle is taken into account.
- **Modified Reference-Life according ISO 16281**
  Using the factors a1 and aISO the influence of reliability, lubrication and cleanness is considered in modified Reference-Life Lnmr.

Static safety

- **Static safety according ISO 76**
  The static safety is calculated as $S = C0/P0$ using the static load capacity C0 and the static equivalent load P0. The static load capacity is based on a contact pressure of 4200 MPa for ball bearings and 4000MPa for roller bearings.

- **Static safety based on the load distribution**
  The static safety factor SF is calculated using the actual contact stress and the permissible contact stress. For ball bearings the safety factor is calculated as $SF = (p_{perm}/p_{max})^3$ and for roller bearings as $SF = (p_{perm}/p_{max})^2$.
  As alternative the static safety factor SF can also be based on rolling element forces.

- **Static safety according to ISO 17956**
  The static safety factor S0eff is calculated based on the draft for ISO 17956. For ball bearings it is based on the rolling element forces, for roller bearings on the force per lamina. A certain influence of tilting angles is therefore covered, but no edge stresses.

Settings for calculation

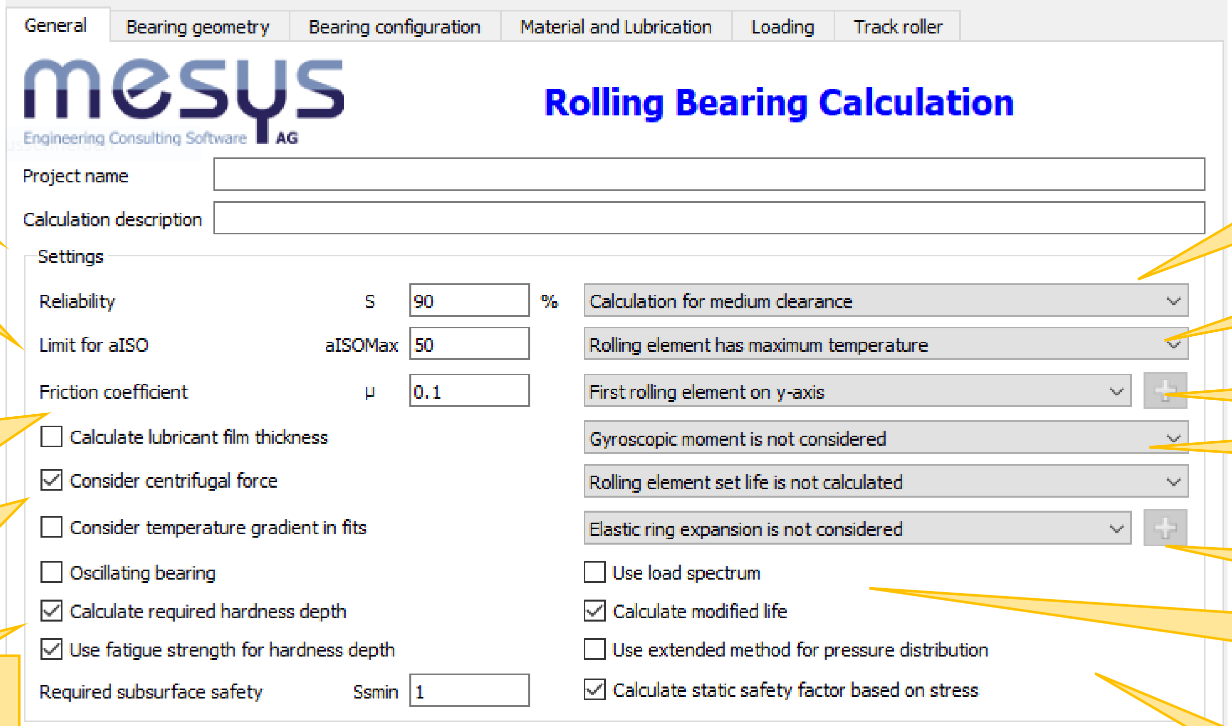
Reliability

Maximum value for aISO

Friction coefficient for calculation of torque

Centrifugal force can be considered for fast running bearings

For surface hardened bearings the required hardness depth can be calculated



Position in tolerance field for clearance

Temperature for rolling element

Position for first rolling element

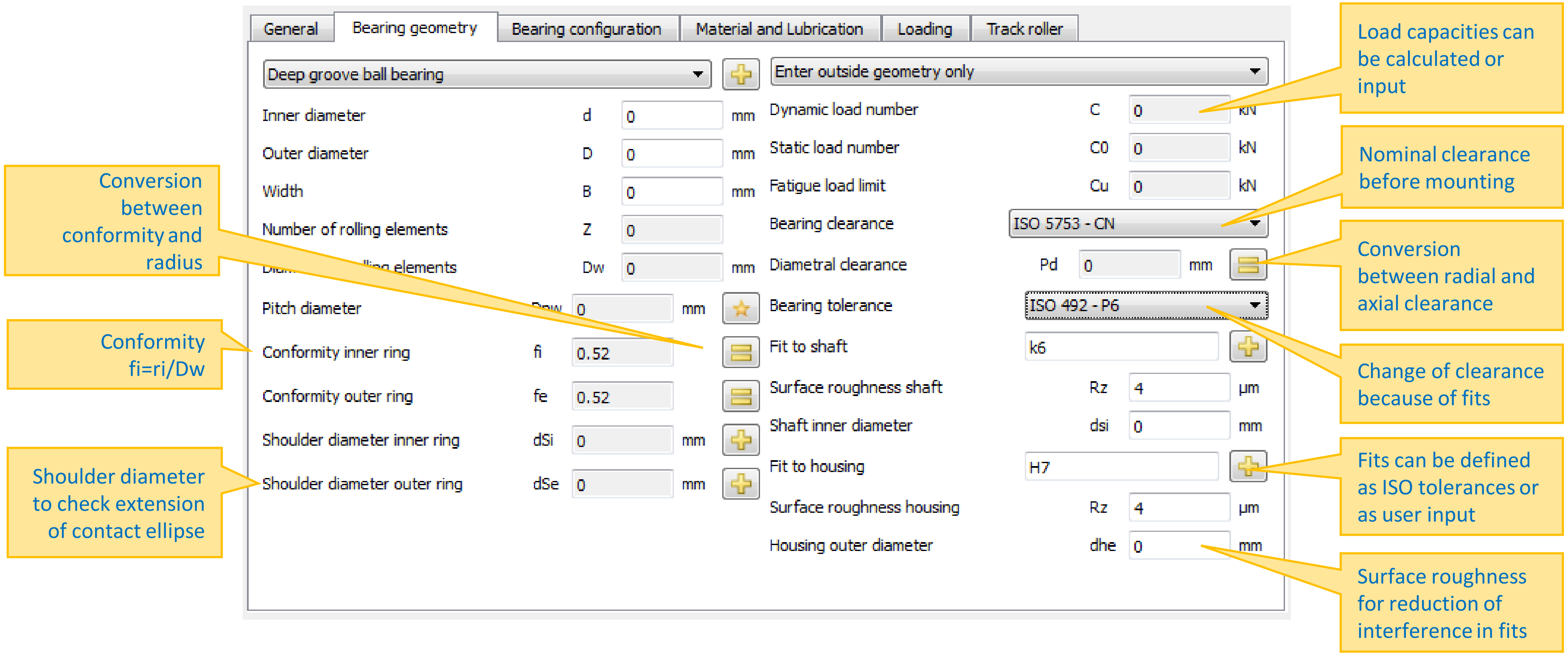
Gyroscopic moment

Elastic ring expansion

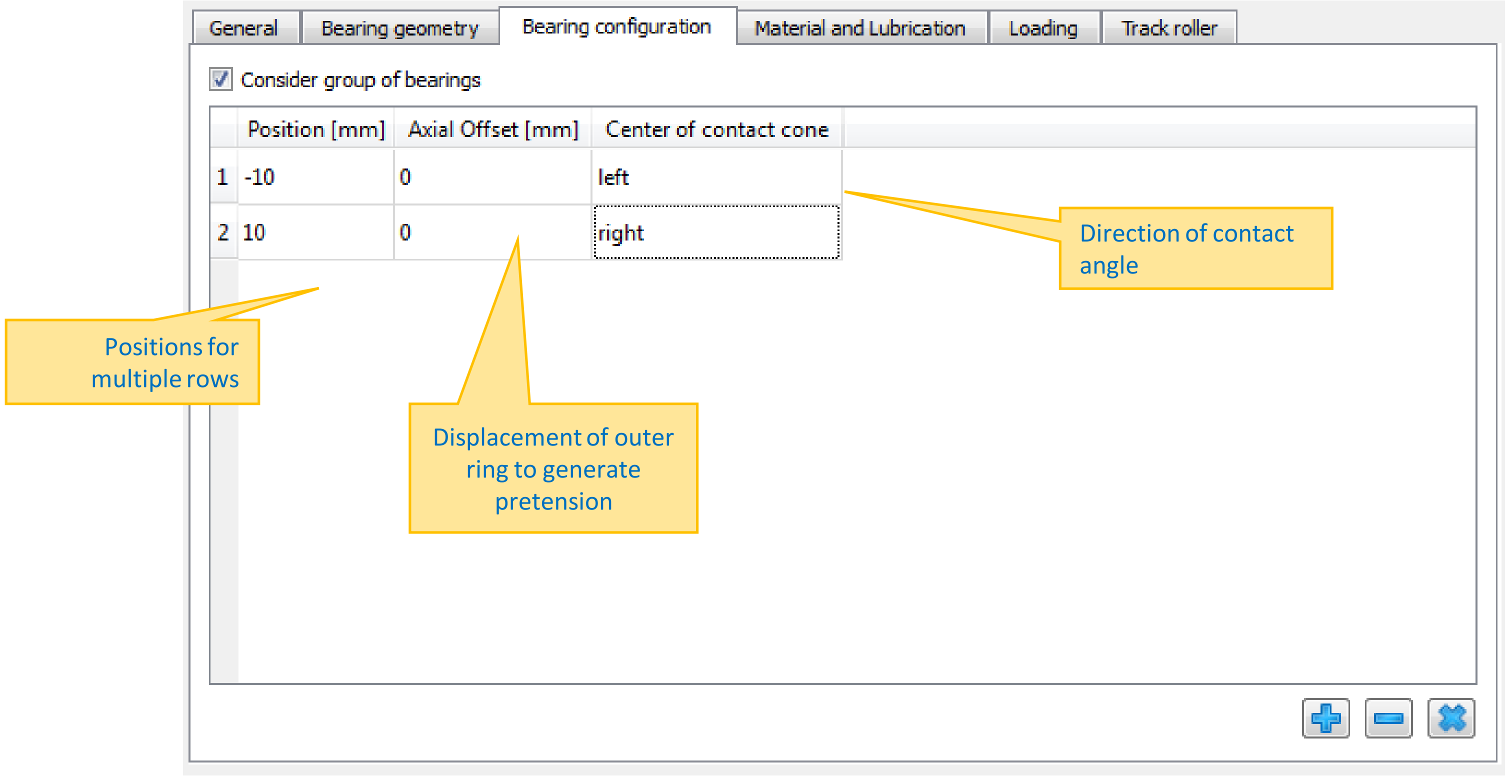
Calculation with load spectra is possible

Extended method for pressure distribution in roller bearings

Bearing geometry



Bearing configuration for multiple row bearings



Multiple row bearings can be defined easily using the bearing configuration.
The bearing rings are connected rigidly. Thermal elongation is considered in axial offset.

Material and lubrication

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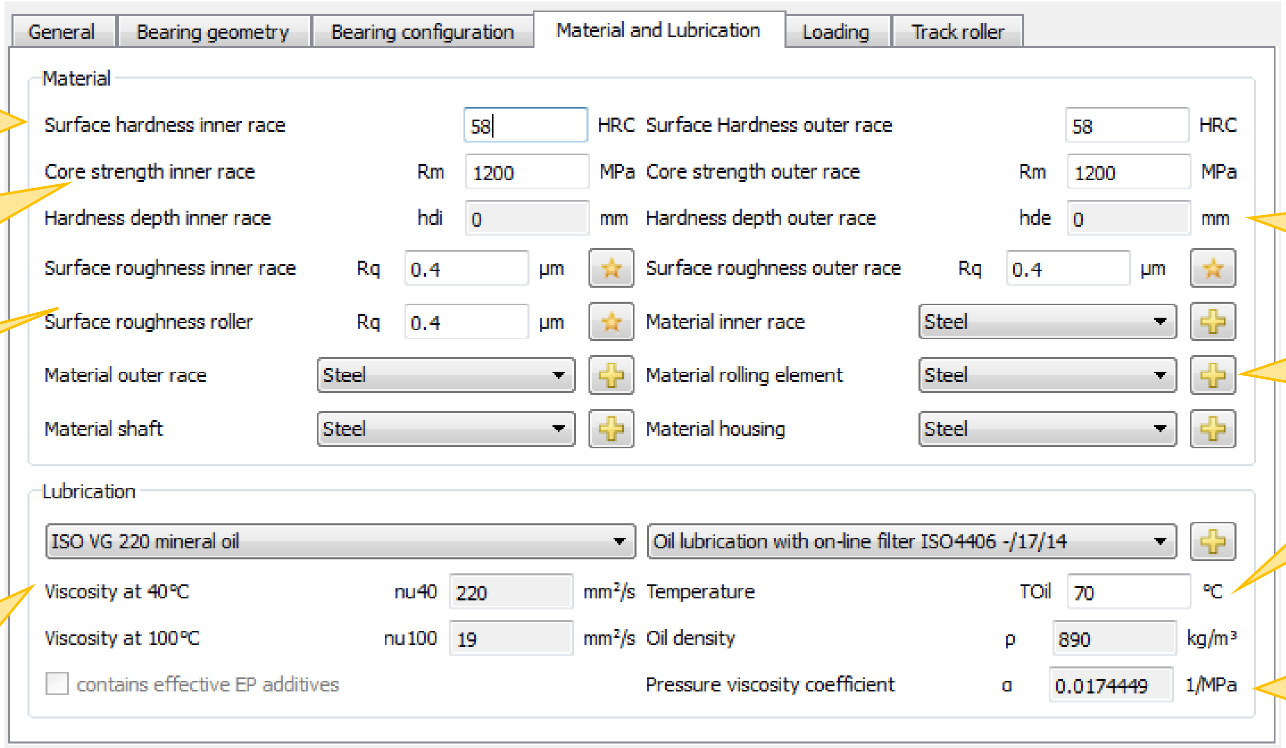
The surface hardness can lead to a reduction of load capacities

Core strength for the calculation of hardness depth

Surface roughness for the calculation of lubricant film thickness

Inputs for lubrication to calculate modified life



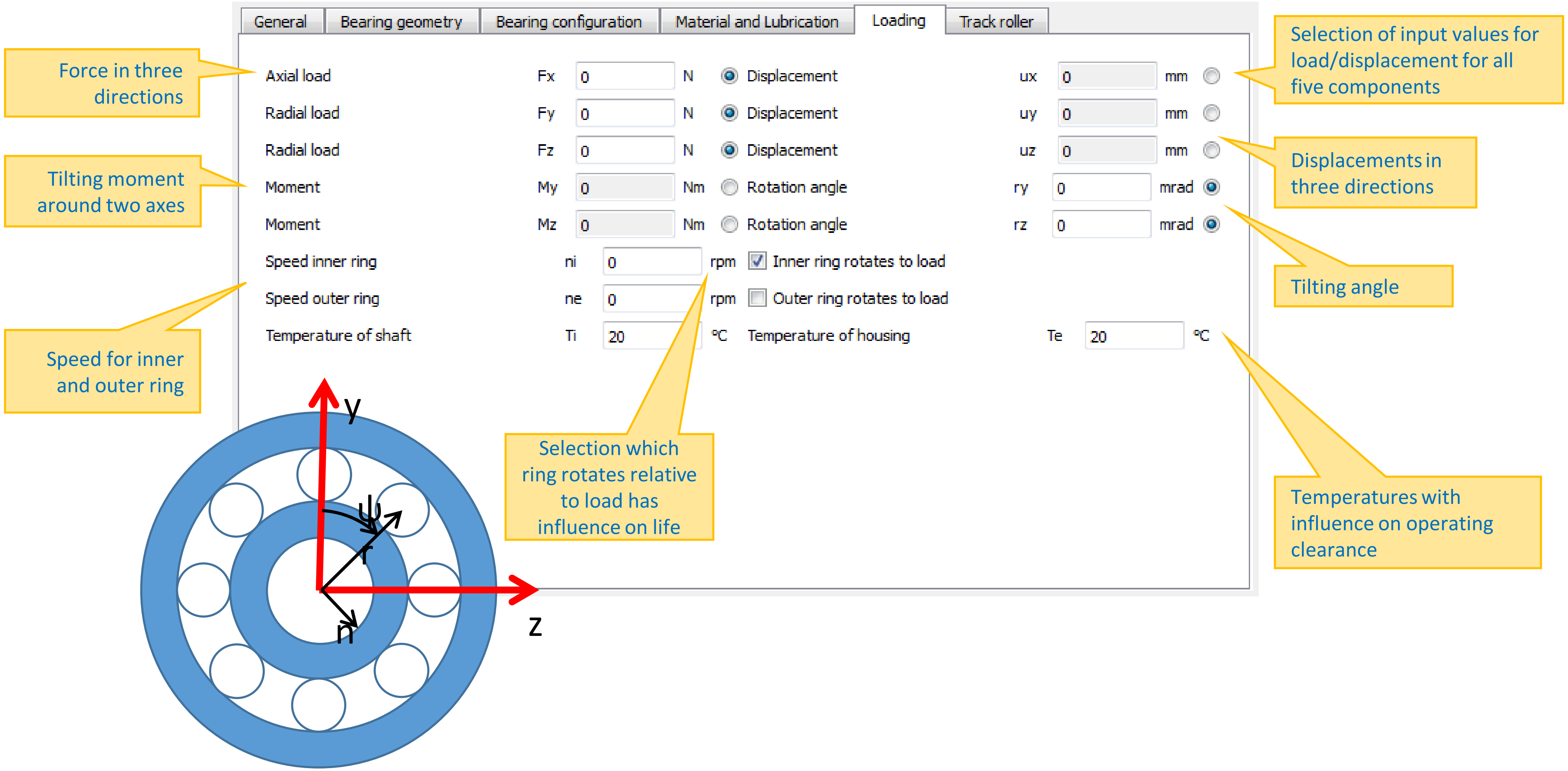
Hardness depth as input or required hardness depth as output

Material data for calculation of load distribution, user input available

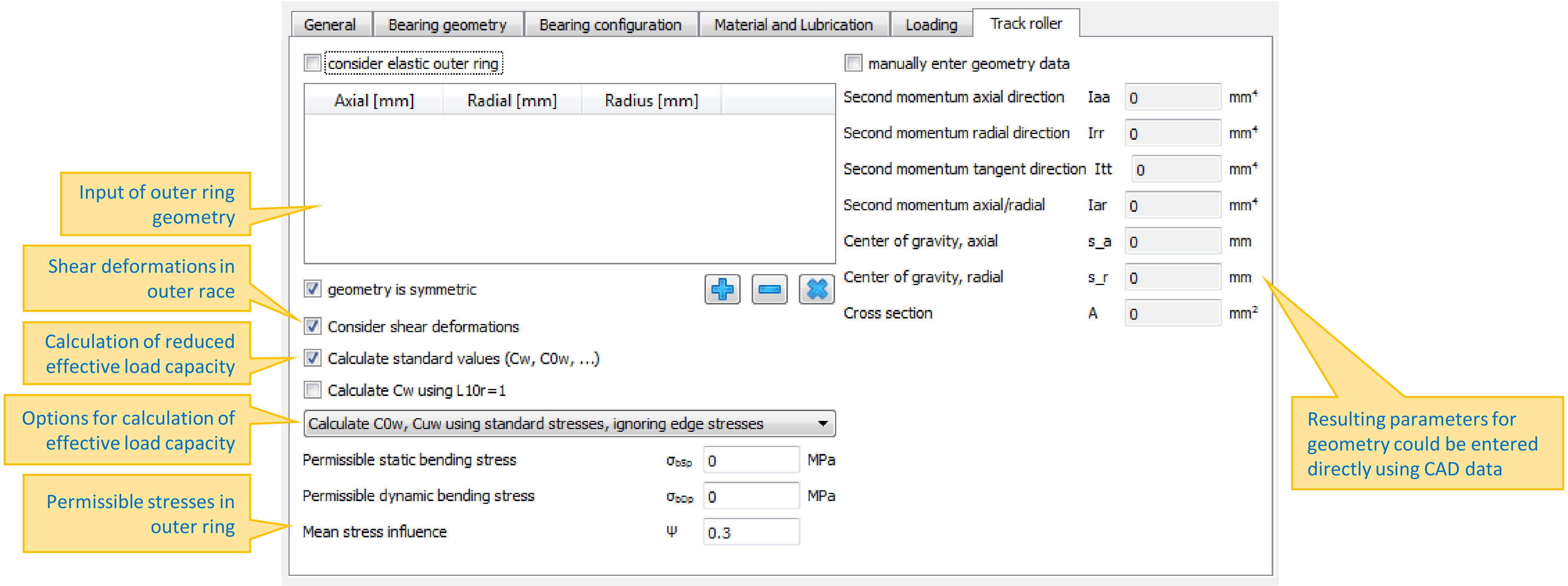
Selection for lubricant cleanliness or user input for eC

Pressure viscosity coefficient for the calculation of lubricant film thickness

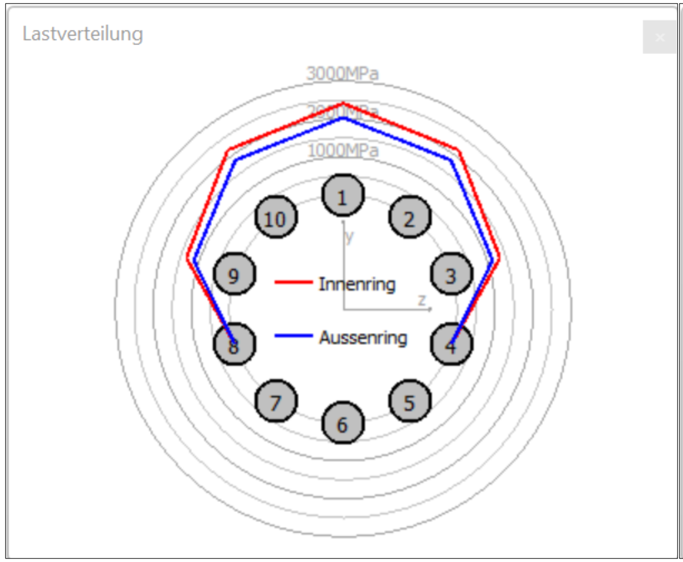
Loading of bearing

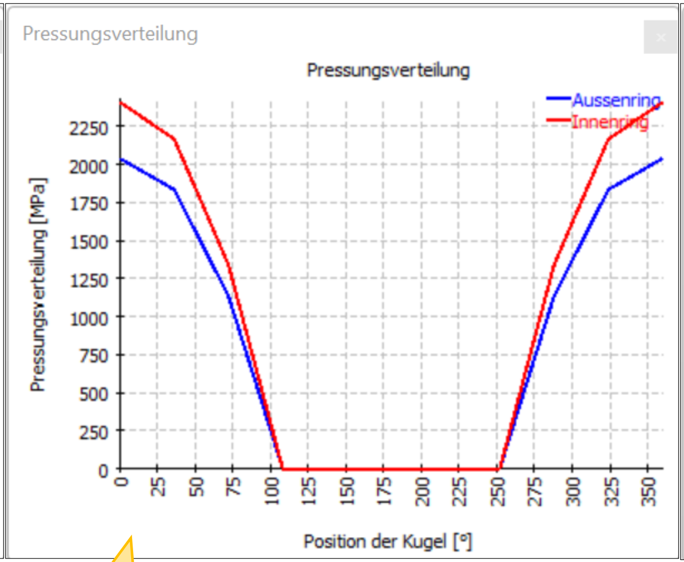


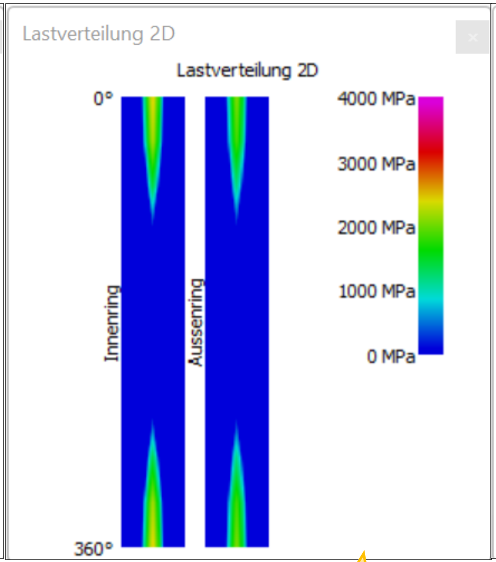
Calculation with elastic outer ring for track rollers

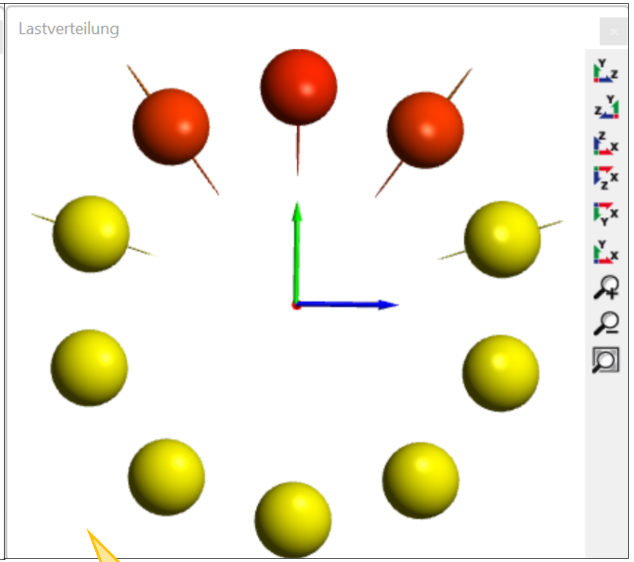


Distribution of contact stress







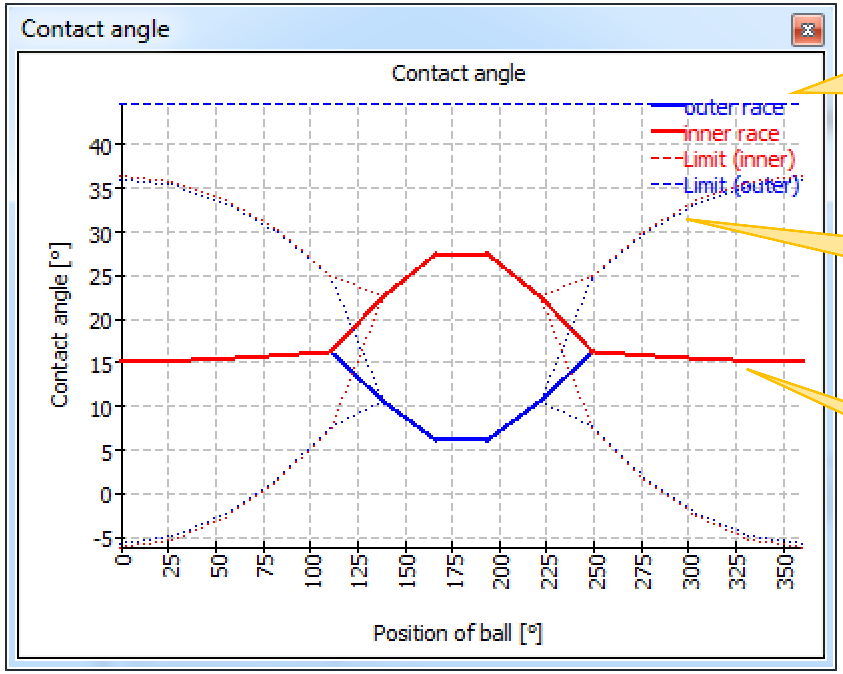


Contact stress over angular position of rolling element

Load distribution 2D

Load distribution 3D

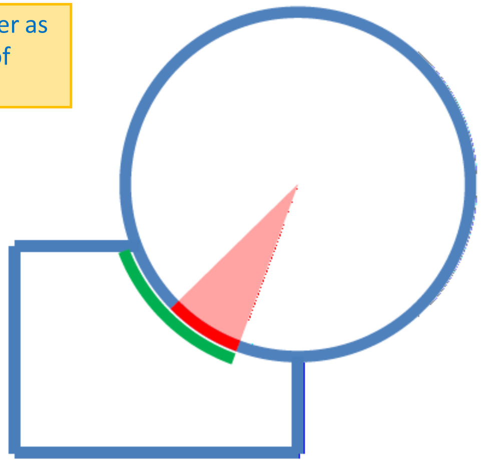
Extension of contact ellipse



Contact ancle at shoulder as limit for the extension of contact ellipse

Extension of contact ellipse

Contact angle in the center of contact ellipse

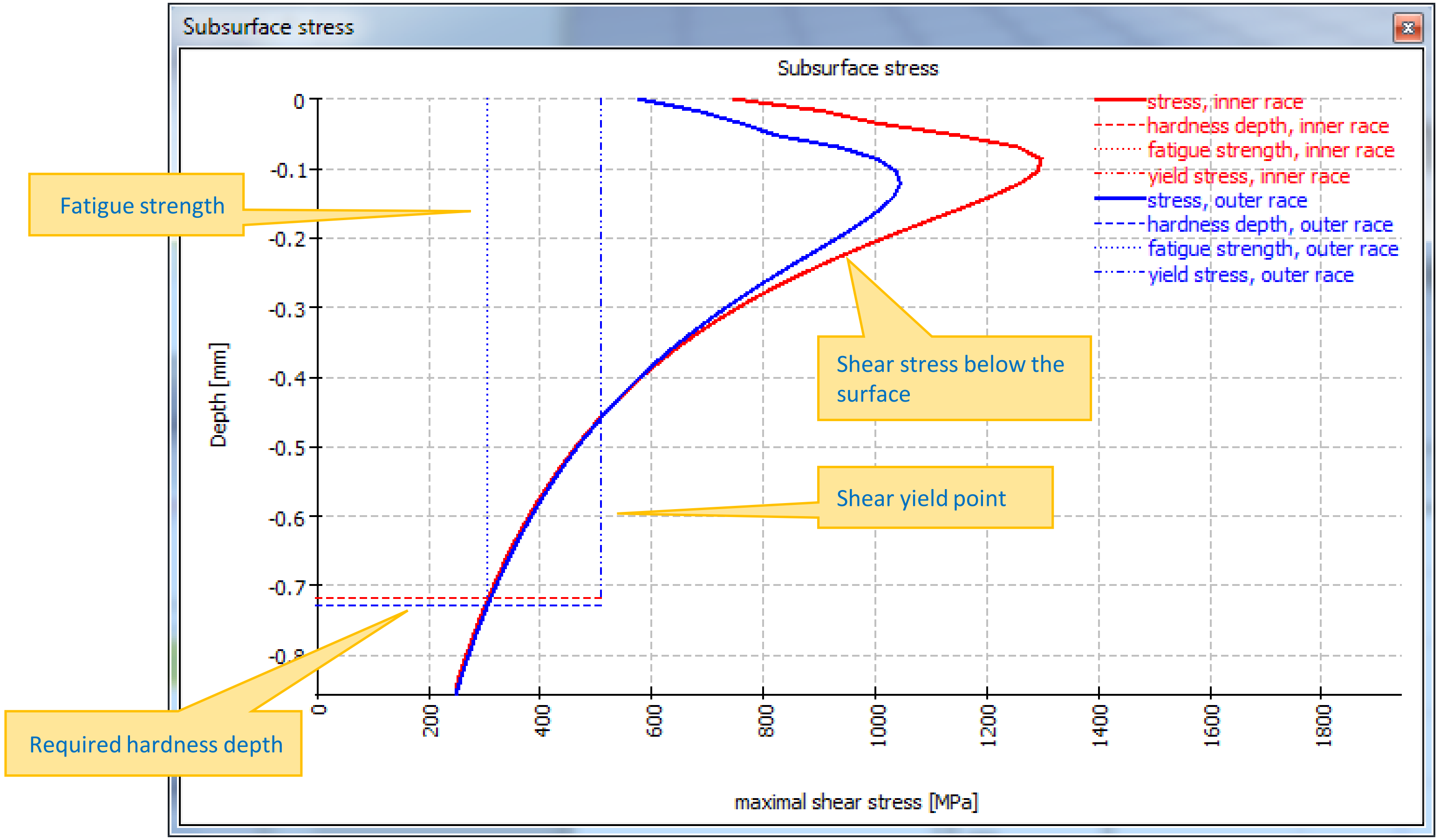


Extension contact ellipsis inner ring	dCimax	58.1451	mm
Extension contact ellipsis outer ring	dCemin	71.8924	mm
Ellipsis length ratio outer race	eLR_e	123.284	%
Ellipsis length ratio inner race	eLR_i	121.799	%

Maximum extension of the pressure ellipse

The length ratio is the relationship between the green and the red line

Extension of contact ellipse



Bearing stiffness

Graphics for displacement over load

Bearing stiffness matrix

	ux [µm]	uy [µm]	uz [µm]	ry [mrad]	rz [mrad]
Fx [N]	58.214	67.753	-0.000	-0.000	-1053.343
Fy [N]	67.761	236.142	-0.000	0.000	-1982.788
Fz [N]	-0.000	-0.000	268.921	2374.462	-0.000
My [Nm]	-0.000	-0.000	2.399	31.032	-0.000
Mz [Nm]	-1.064	-2.003	0.000	-0.000	30.455

Stiffness matrix in the report. Here for a radially and axially loaded deep groove ball bearing