Improvements for the bearing calculation according to ISO/TS 16281 in KISSsoft

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KISSsoft

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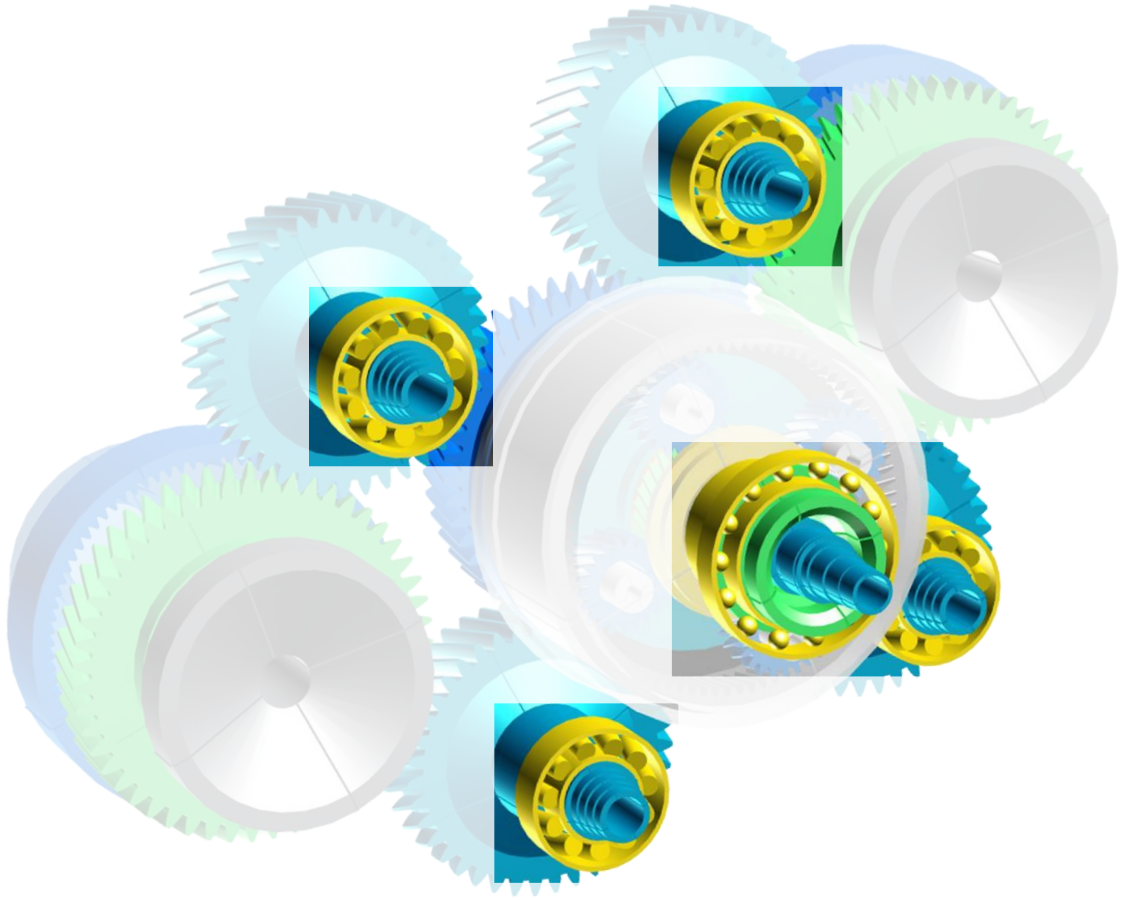
Topics

- Overview calculation methods
- Bearing data in KISSsoft
- Handling missing bearing data



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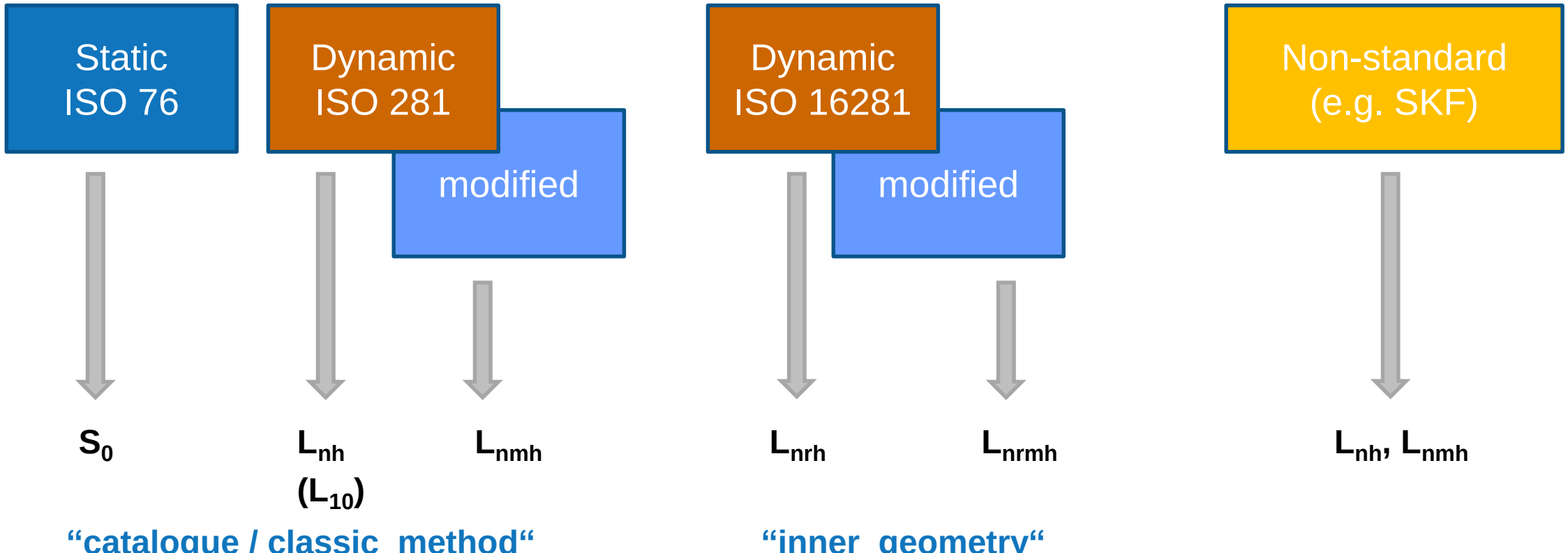
Calculation methods



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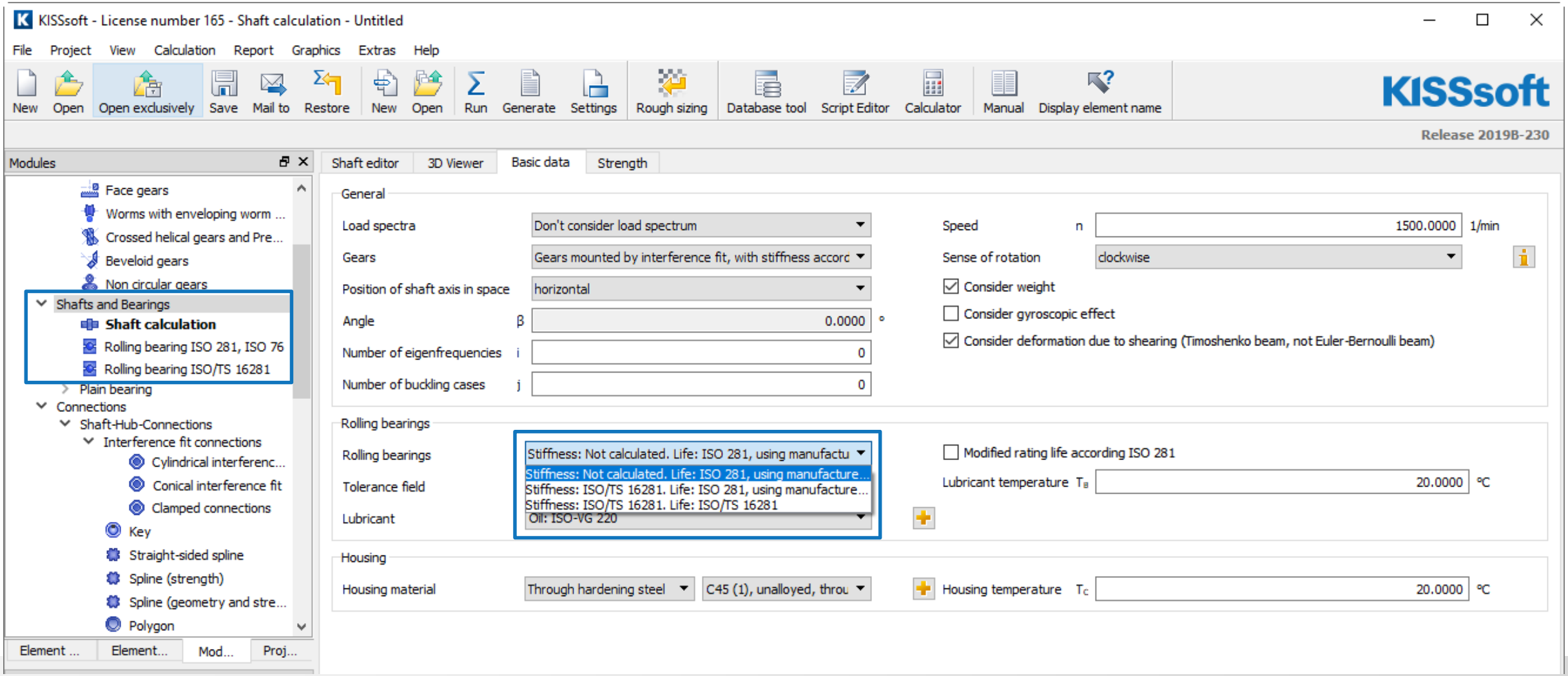

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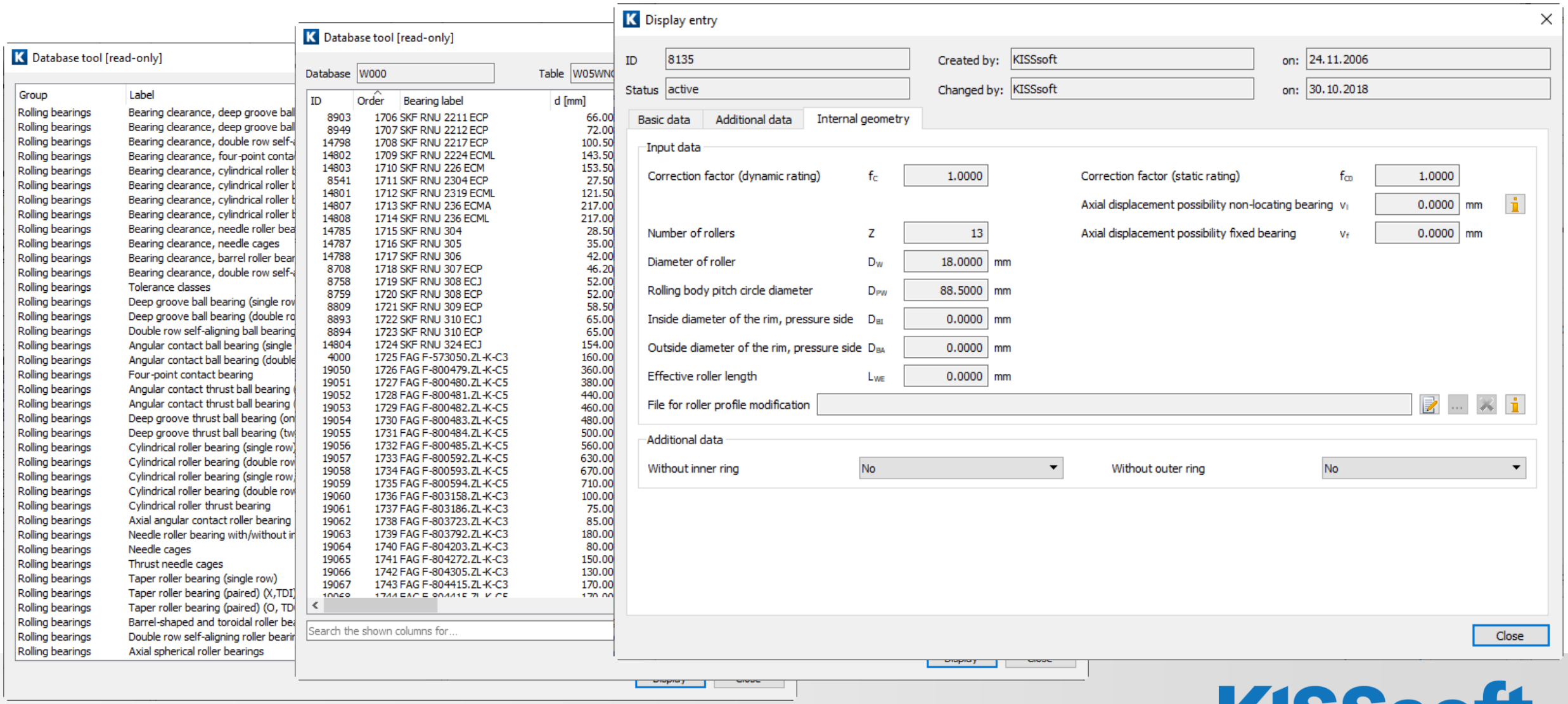

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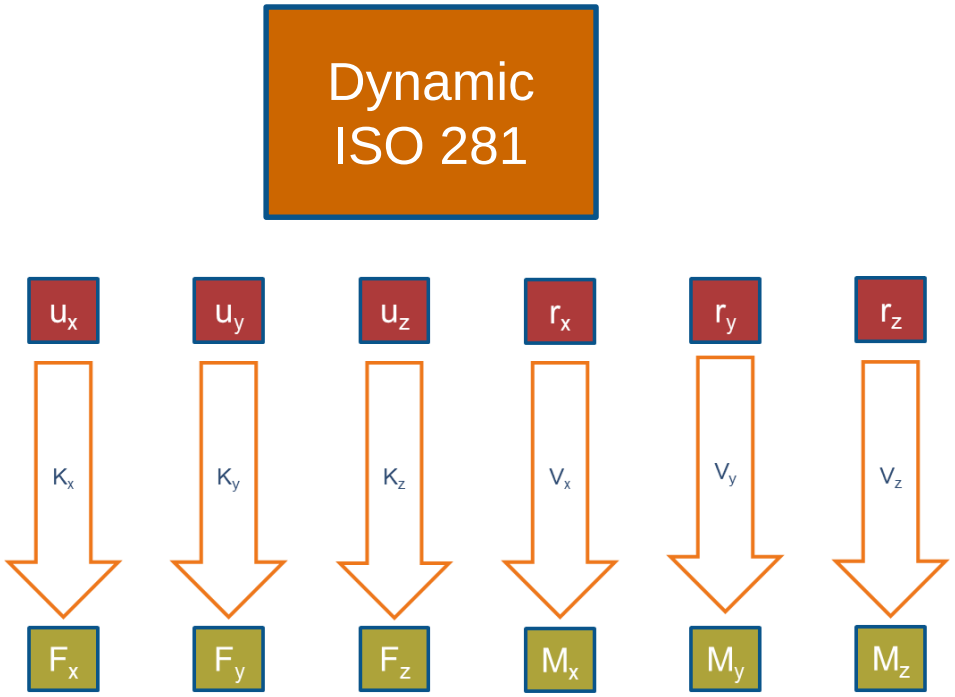
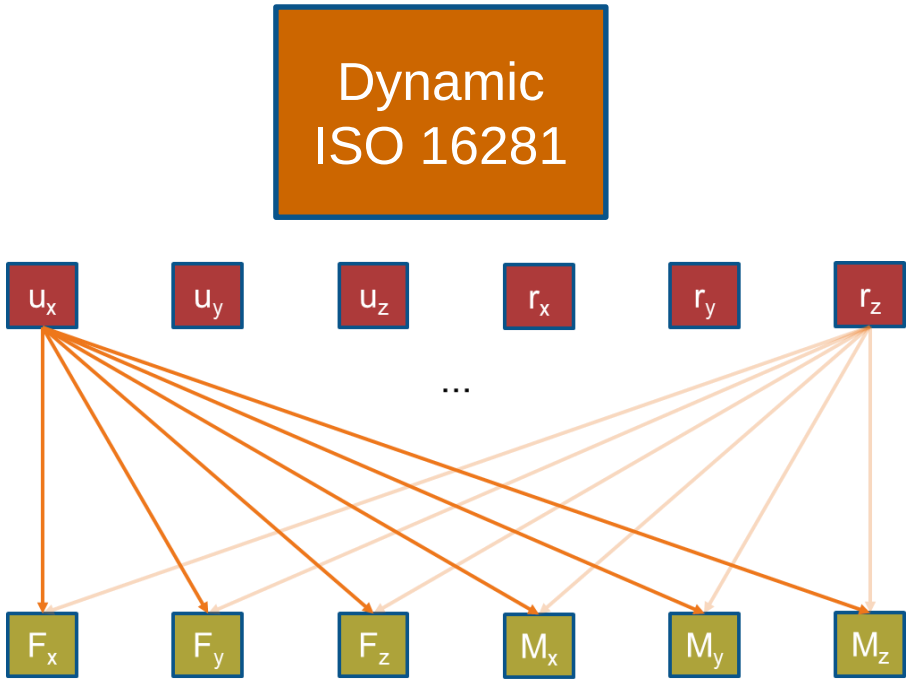
Calculation methods



“catalogue / classic method“



“inner geometry“

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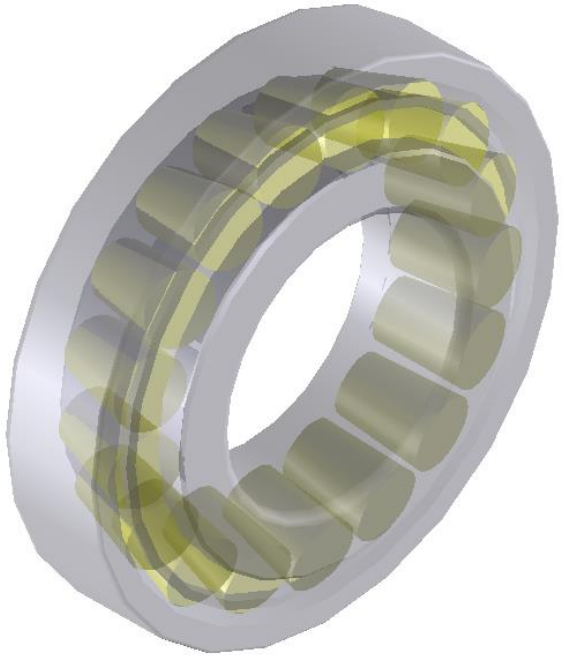

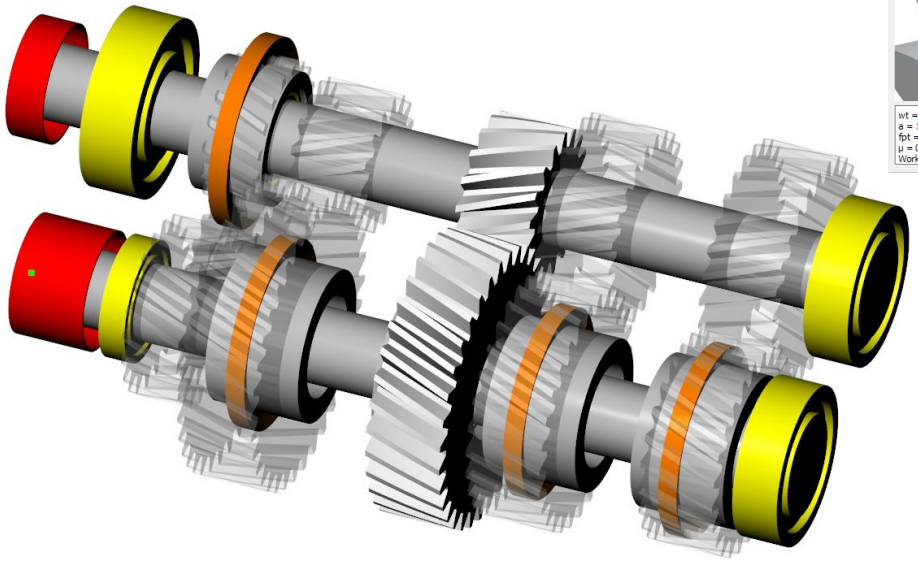

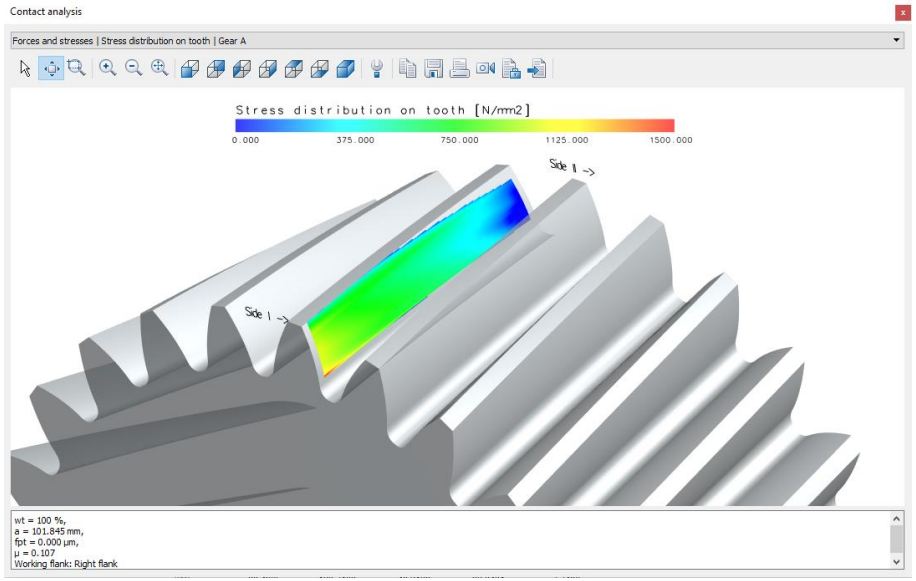

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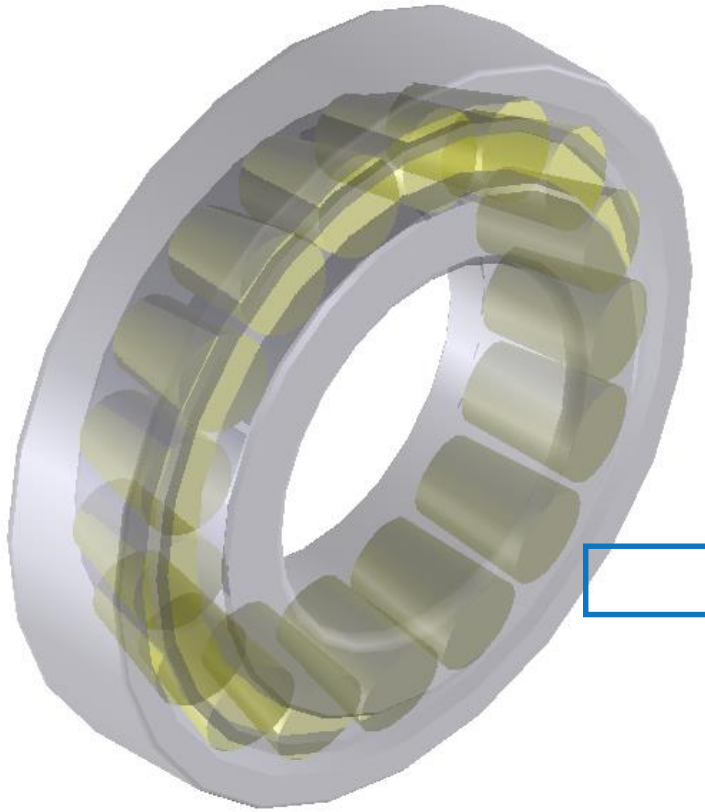
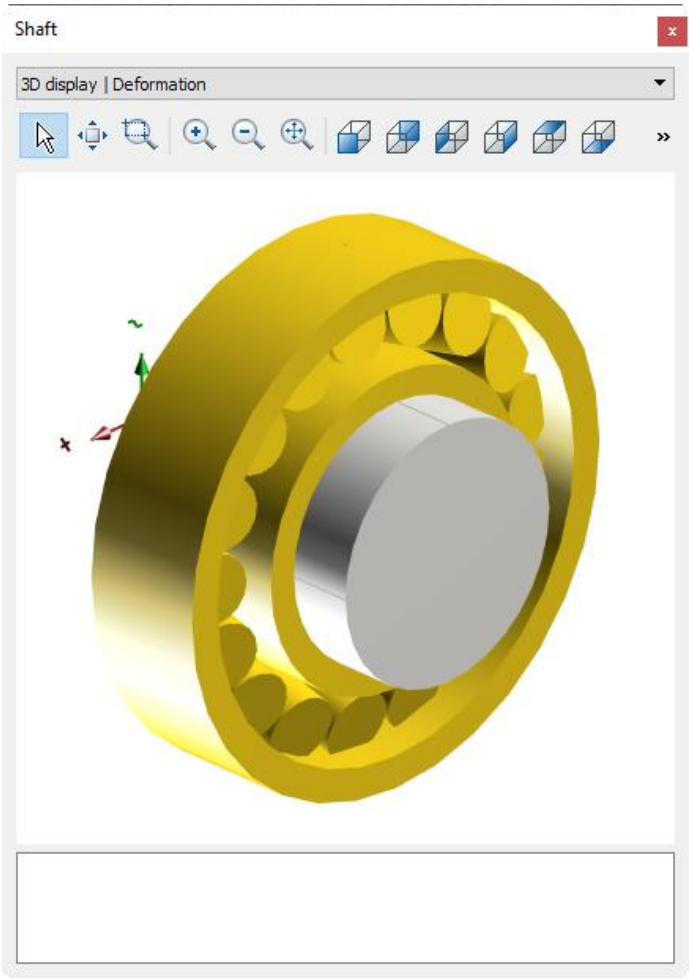
Getting the bearing inner geometry





ISO 76

ISO 281

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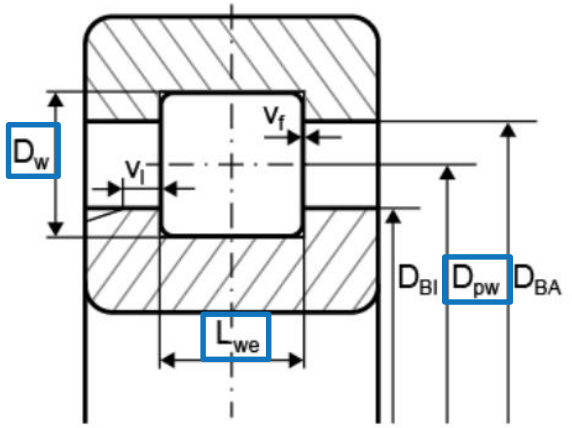
Getting the bearing inner geometry (radial roller bearings)

ISO 76

$$C_{0r} = 44 \cdot \left(1 - \frac{\boldsymbol{D_{we}} \cdot \cos\alpha}{D_{pw}}\right) \cdot i \cdot \boldsymbol{Z} \cdot \boldsymbol{L_{we}} \cdot \boldsymbol{D_{we}} \cdot \cos\alpha$$

ISO 281

$$C_r = b_m \cdot f_c \cdot (i \cdot \boldsymbol{L_{we}} \cdot \cos\alpha)^{\frac{7}{9}} \cdot \boldsymbol{Z}^{\frac{3}{4}} \cdot \boldsymbol{D_{we}}^{\frac{29}{27}}$$



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+ hard constraints (physical limits, design features)
+ soft constraints (statistics, characteristics)

Significantly improved in 2019

3 unknowns, 2 equations and additional constraints

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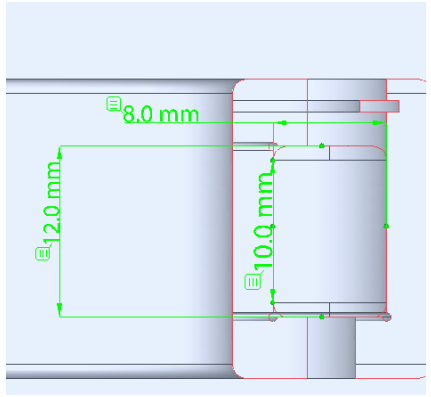
Full complement cylindrical roller bearing

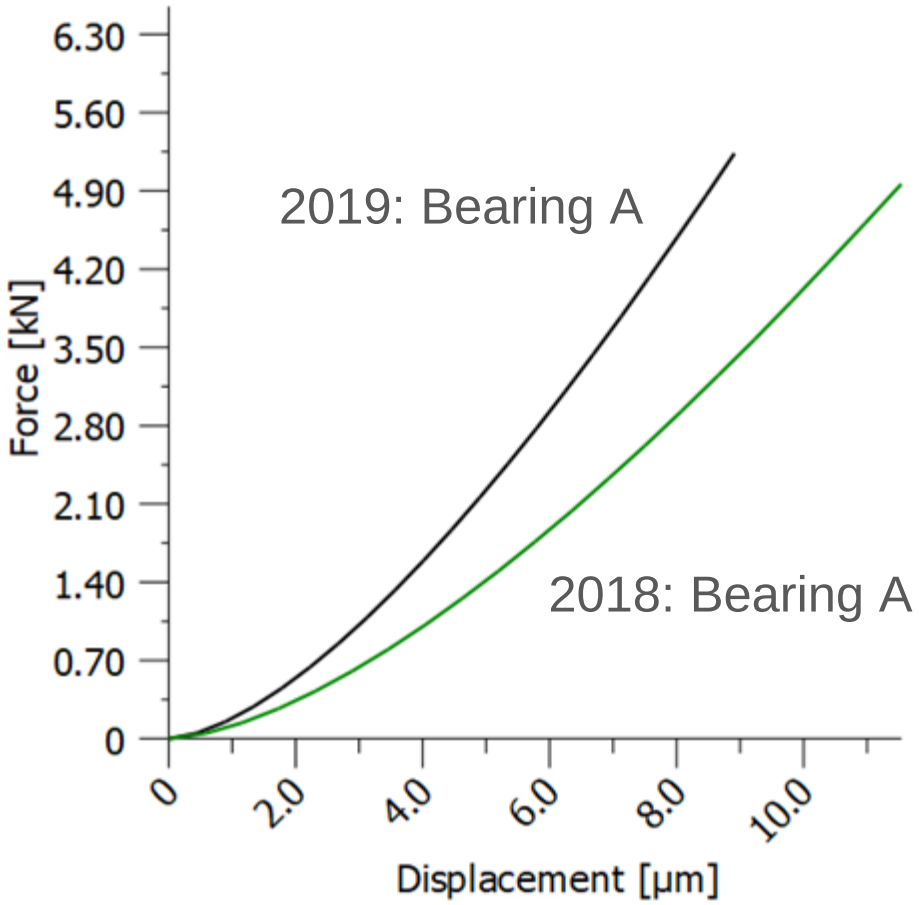
2018: Bearing A

Number of rolling elements	[Z]	13	
Diameter of rolling element	[D_w]	10.990	mm
Effective length of roller	[L_{we}]	13.415	mm
Reference diameter	[D_{pw}]	53.433	mm
Diameter of inner ring	[d_i]	42.443	mm
Diameter of outer ring	[d_o]	64.423	mm



2019: Bearing A

Number of rolling elements	[Z]	20	
Diameter of rolling element	[D_w]	8.439	mm
Effective length of roller	[L_{we}]	10.693	mm
Reference diameter	[D_{pw}]	54.000	mm
Diameter of inner ring	[d_i]	45.561	mm
Diameter of outer ring	[d_o]	62.439	mm



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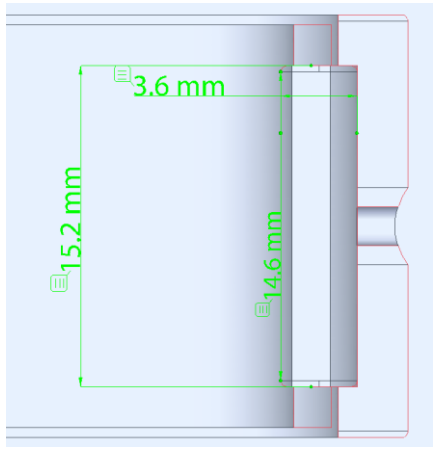
Improvements for the bearing calculation according to ISO/TS 16281 in KISSsoft

Without inner and/or outer ring

Approximation, 2018

Number of rolling elements	[Z]	13	
Diameter of rolling element	[D_w]	4.767	mm
Effective length of roller	[L_{we}]	19.494	mm
Reference diameter	[D_{pw}]	44.809	mm
Diameter of inner ring	[d_i]	40.041	mm
Diameter of outer ring	[d_o]	49.576	mm



Approximation, 2019

Number of rolling elements	[Z]	17	
Diameter of rolling element	[D_w]	4.831	mm
Effective length of roller	[L_{we}]	14.730	mm
Reference diameter	[D_{pw}]	44.831	mm
Diameter of inner ring	[d_i]	40.000	mm
Diameter of outer ring	[d_o]	49.663	mm

Actual values (typical data)

Number of rolling elements	[Z]	21	
Diameter of rolling element	[D_w]	4.000	mm
Effective length of roller	[L_{we}]	15.179	mm
Reference diameter	[D_{pw}]	44.000	mm
Diameter of inner ring	[d_i]	40.000	mm
Diameter of outer ring	[d_o]	48.000	mm

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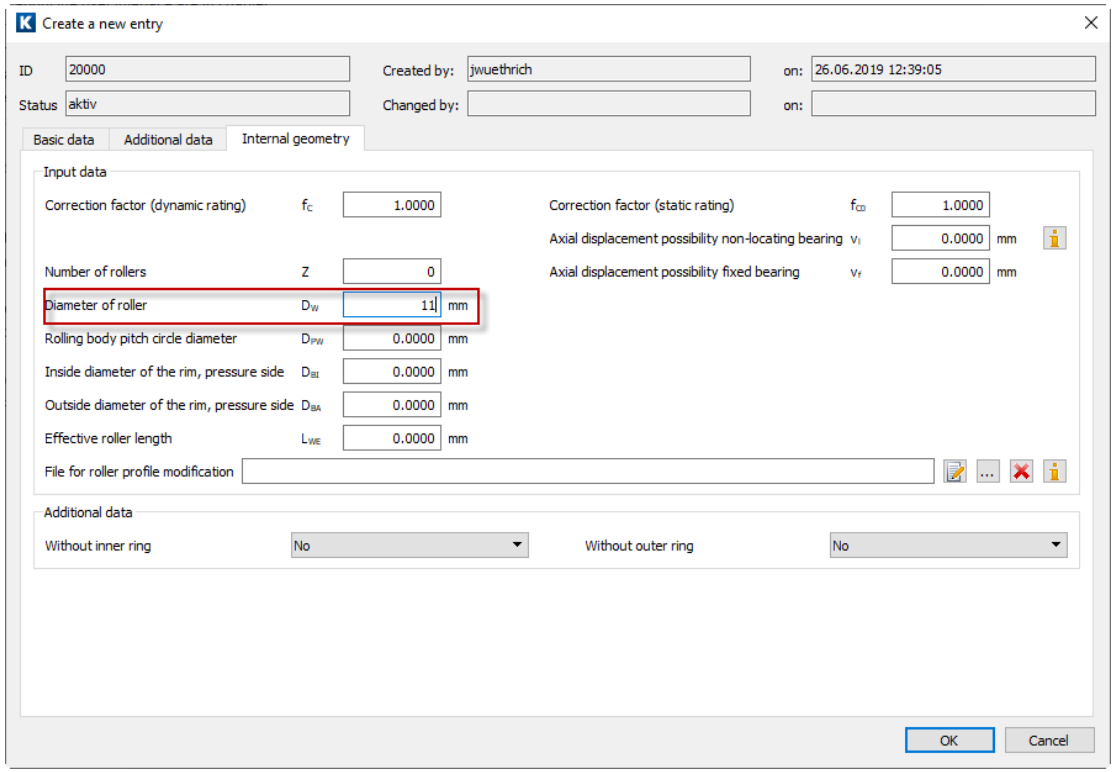
Handling incomplete data sets



Approximation, 2019

Calculation with approximate bearings internal geometry			
Number of rolling elements	[Z]	13	
Diameter of rolling element	[D_w]	11.000	mm
Effective length of roller	[L_{we}]	10.293	mm
Reference diameter	[D_{pw}]	60.558	mm
Diameter of inner ring	[d_i]	49.558	mm
Diameter of outer ring	[d_o]	71.558	mm

Actual values

Calculation with approximate bearings internal geometry			
Number of rolling elements	[Z]	14	
Diameter of rolling element	[D_w]	11.000	mm
Effective length of roller	[L_{we}]	9.560	mm
Reference diameter	[D_{pw}]	60.500	mm
Diameter of inner ring	[d_i]	49.500	mm
Diameter of outer ring	[d_o]	71.500	mm

Improvements for the bearing calculation according to ISO/TS 16281 in KISSsoft

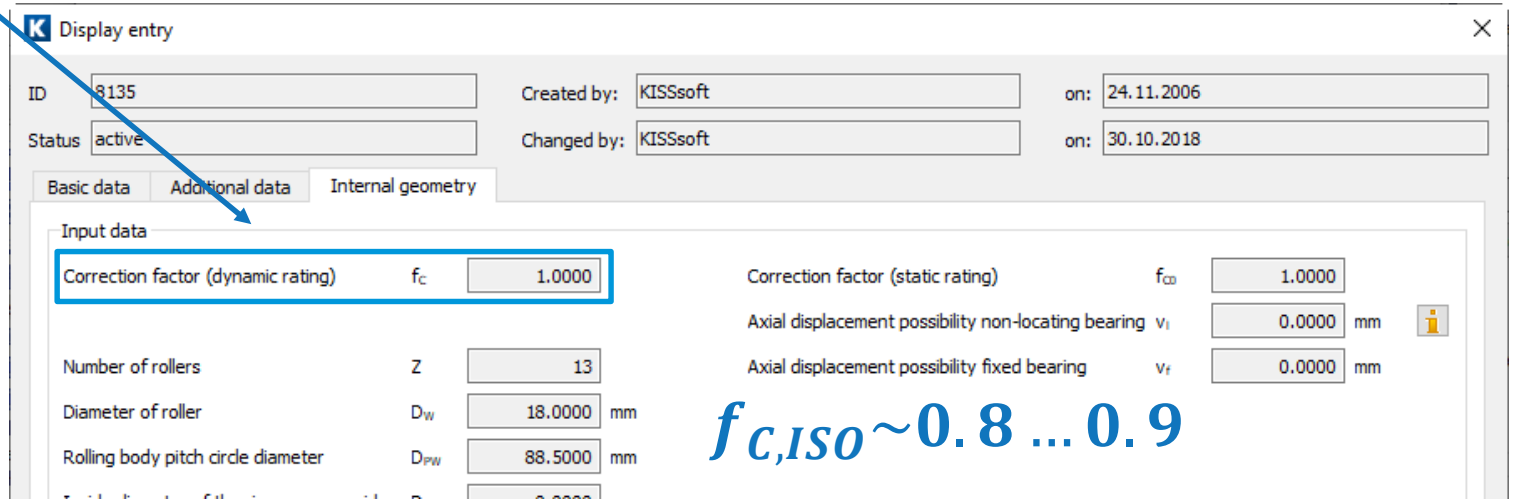
Limitations

ISO 76

$$C_{0r,ISO} = f_{C_0,ISO} \cdot C_{0r} = 44 \cdot \left(1 - \frac{D_{we} \cdot \cos\alpha}{D_{pw}}\right) \cdot i \cdot Z \cdot L_{we} \cdot D_{we} \cdot \cos\alpha$$

ISO 281

$$C_{r,ISO} = \boldsymbol{f_{C,ISO}} \cdot C_r = b_m \cdot f_c \cdot (i \cdot L_{we} \cdot \cos\alpha)^{\frac{7}{9}} \cdot Z^{\frac{3}{4}} \cdot D_{we}^{\frac{29}{27}}$$



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Without inner and/or outer ring

Approximation, 2018

Number of rolling elements	[Z]	13	
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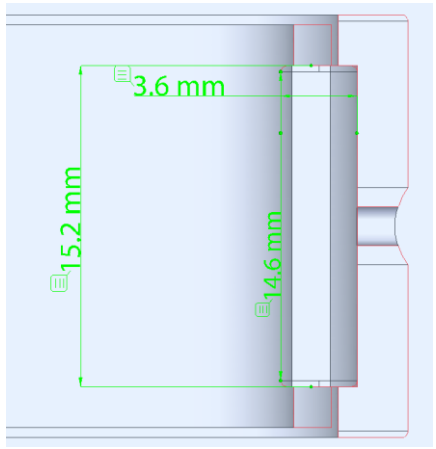
Effective length of roller	[L_{we}]	19.494	mm
Reference diameter	[D_{pw}]	44.809	mm
Diameter of inner ring	[d_i]	40.041	mm
Diameter of outer ring	[d_o]	49.576	mm



Approximation, 2019

Number of rolling elements	[Z]	17	
Diameter of rolling element	[D_w]	4.831	mm
Effective length of roller	[L_{we}]	14.730	mm
Reference diameter	[D_{pw}]	44.831	mm
Diameter of inner ring	[d_i]	40.000	mm
Diameter of outer ring	[d_o]	49.663	mm

Typical values (typical data)

Number of rolling elements	[Z]	21	
Diameter of rolling element	[D_w]	4.000	mm
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Reference diameter	[D_{pw}]	44.000	mm
Diameter of inner ring	[d_i]	40.000	mm
Diameter of outer ring	[d_o]	48.000	mm

Approximation, 2018, f_{ISO}=0.85

Number of rolling elements	[Z]	22	
Diameter of rolling element	[D_w]	3.569	mm
Effective length of roller	[L_{we}]	14.975	mm
Reference diameter	[D_{pw}]	43.569	mm
Diameter of inner ring	[d_i]	40.000	mm
Diameter of outer ring	[d_o]	47.138	mm

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Thank you for your attention!

Sharing Knowledge

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