KISSsoft
Calculation programs for machine design

KISSsoft, FEM gear body deformation and it's influence on the LTCA

Application and use of DPK module

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SHARING KNOWLEDGE

1 Document information

1.1 Document change record

Revision	Date	Author	Comments
0	5.3.2017	HD	Original document

1.2 Table of content

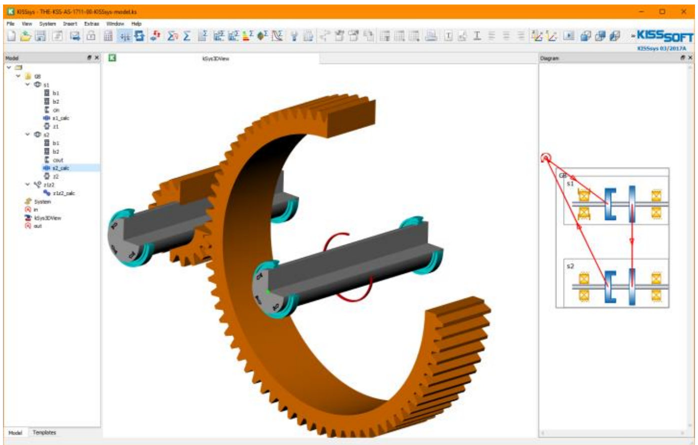
1.3 References

[1] KISSsoft release 03-2017A

2 Data preparation

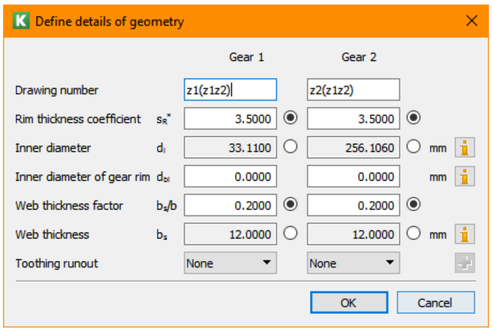
2.1 KISSsys model

See file THE-KSS-AS-1711-00-KISSsys-model.ks, use with release 03-2017A or later.
There, a simple one stage gearbox is modelled. The model is perfectly symmetrical such that a symmetrical load distribution of over the face width will result as long as no influence of the (asymmetrical) gear body is considered. Note that even the power input and power output through couplings is located in the middle of the shaft in order to achieve symmetry even if this is not a realistic, practical design.

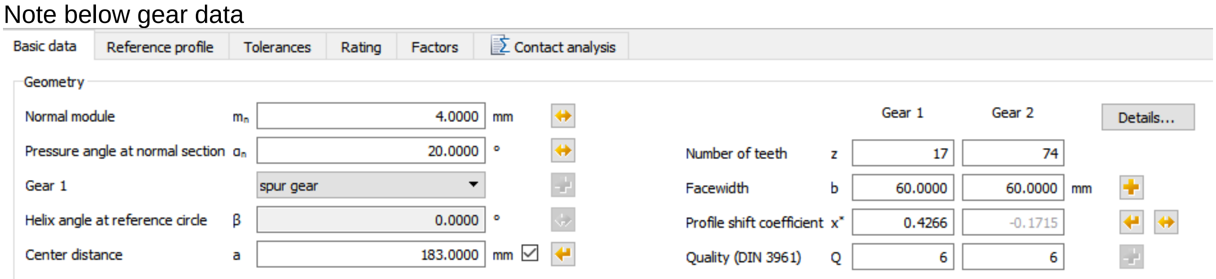


2.2 Exported gear file

From the above KISSsys model, a gear pair file is exported: THE-KSS-AS-1711-00-Gearpair.Z12
Note that some parameters of the gear body (web thickness and gear rim thickness) is already defiend in tab “Basic data”, button “Details”.



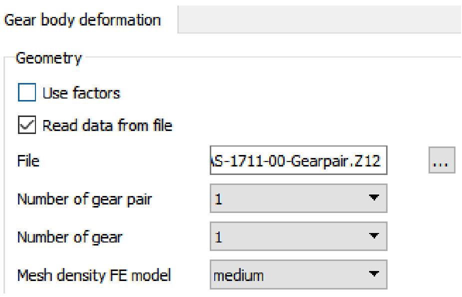
Note below gear data



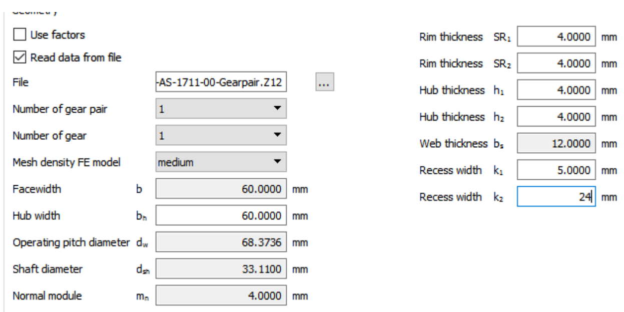
2.3 Creating the gear body stiffness matrix

See file THE-KSS-AS-1711-00-Gear-body-stiffness.K16

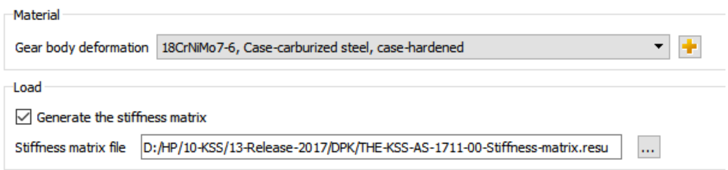
Start KISSsoft module “DPK”. Set the flags as shown below. Press “…” and import the gear data for the pinion (gear 1 in gear pair 1). Set mesh density to “medium”:



Enter geometry that will result in a soft (so that we see an effect in the results) and asymmetrical gear body:



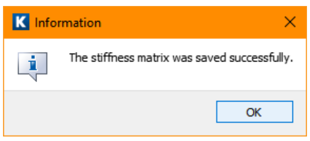
Select the gear body material, activate the below flag and define an output path for the *.resu (that is the stiffness matrix) file:



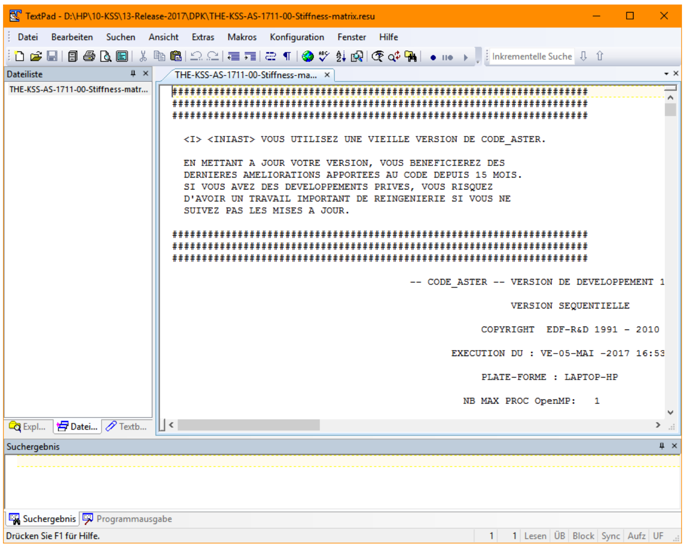
I recommend to save the file before running the calculation.

Run the calculation by pressing “F5” or .

The calculation should complete with:

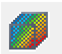


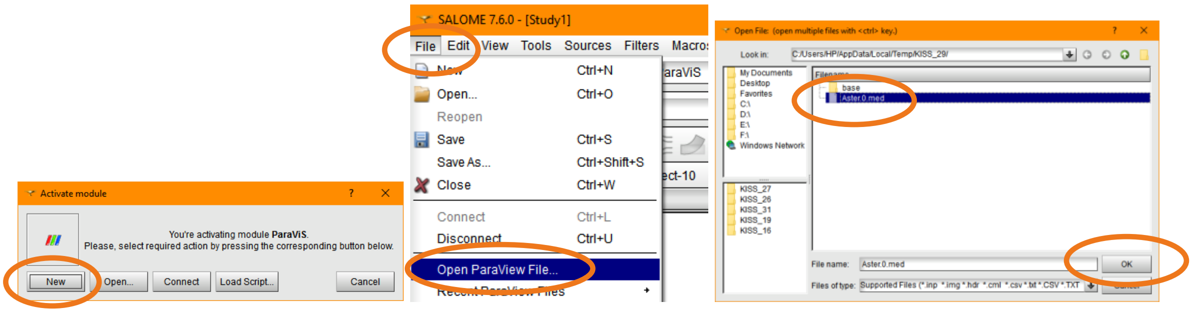
The *.resu file should look like this:



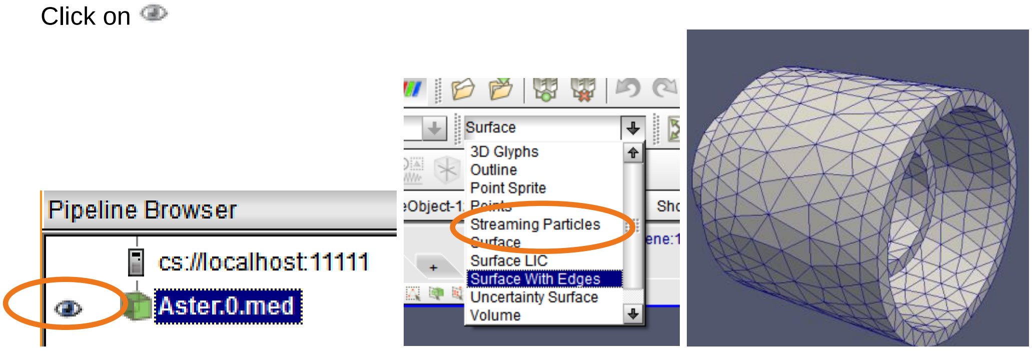
See file THE-KSS-AS-1711-00-Stiffness-matrix.resu

2.4 Checking the FEM body calculated

To see the geometry / FEM mesh, press . Salome will open, press 



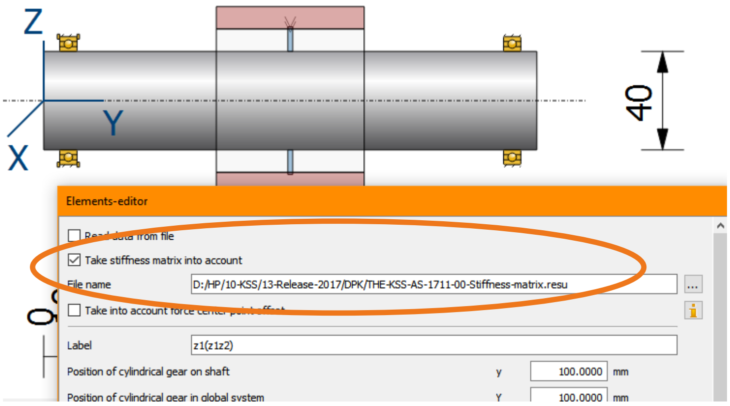
Click on 



3 Import

3.1 Import in KISSsys

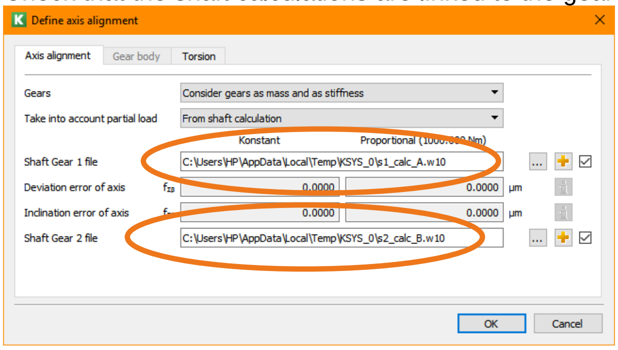
Go back to KISSsys. Open shaft model of pinion shaft. Import the *.resu file into the shaft editor:



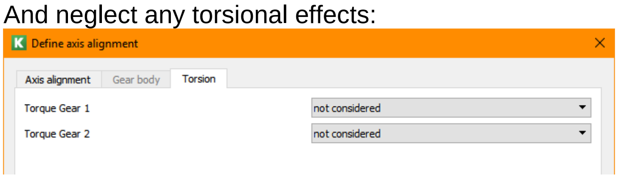
3.2 Contact analysis with consideration of gear body deformation

Now, close the above shaft model and go to the gear calculation.

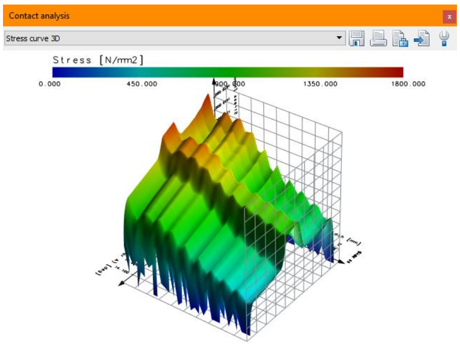
Check that the shaft calculations are linked to the gear pair calculation as shown below:



And neglect any torsional effects:

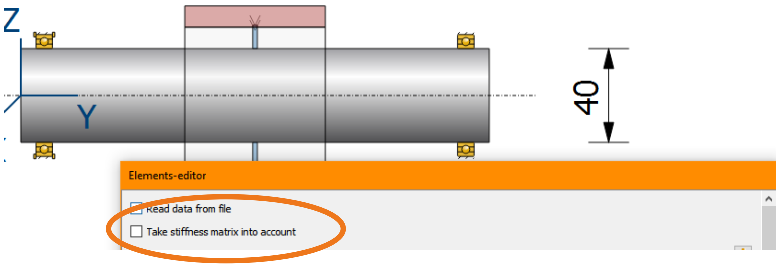


Run the contact analysis. You will find the below stress distribution:

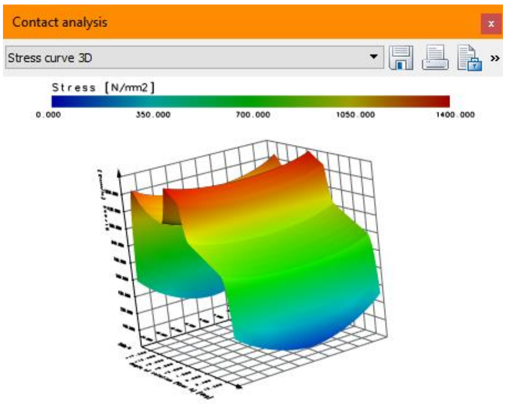


3.3 Contact analysis without of gear body deformation

Go back to the shaft calculation of the pinion shaft and deactivate the flag:



Close the KISSsoft shaft file and go back to the gear pair file. Run the contact analysis again to find:



3.4 Assessment

In the calculation without influence of the gear body, we find – as expected – a symmetrical load distribution. We find that – due to the bending of the two shafts and because no crowning is applied – there is more load on the outer sides of the face width.

If we consider the gear body deformation, we see a “rippling” effect. This is because the FEM mesh is not fine enough in the gear body deformation calculation (the programmers are aware of this). Also, we see that on side II, where the gear body is soft, there is less load.

So, the results are as expected.

The usage of this module is not yet as it should be and the programmers are aware that the usability should be improved. However, in principle, the module DPK can be used for detailed analysis.