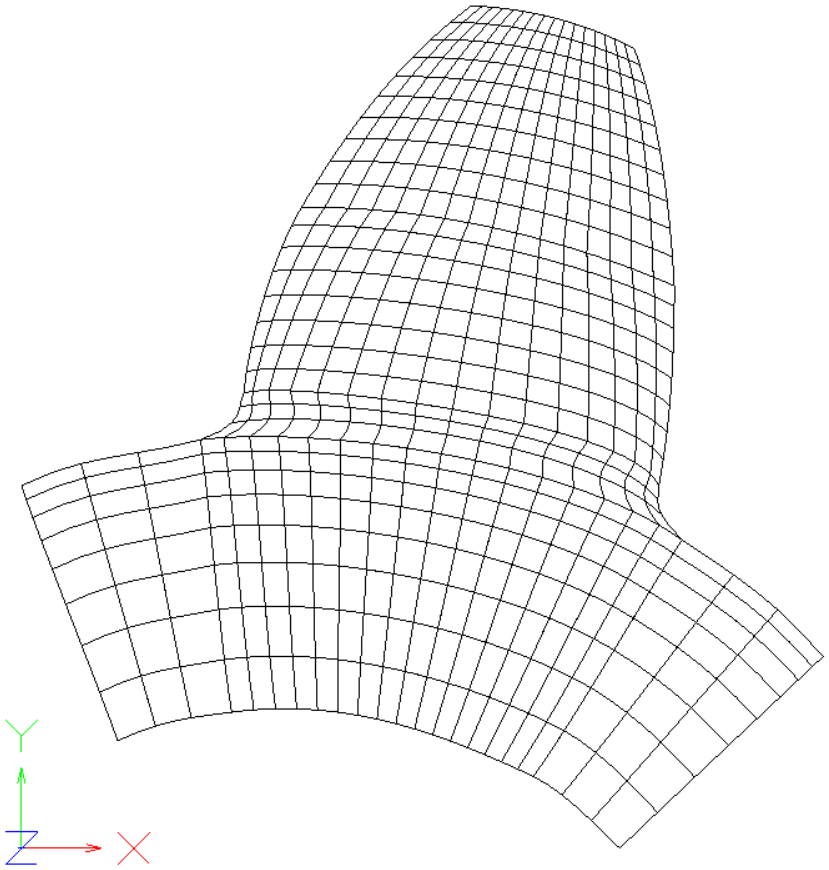
Z88 AURORA® EXAMPLE MANUAL

Example 12: Tooth base load

(Plane stress element No. 7 with 8 nodes)



12. Example: Tooth root strength (Plane stress element No. 7 with 8 nodes)

The calculation of load capacity of spur gears is one of the most demanding tasks of the machine element analysis. This example should give a qualitatively overview by using a linear strength determination with an idealized geometry meaning for example no misalignment and no crowning. The tooth root strength is to be investigated; the tooth dimensions are based on the correct geometric shape.

Input files:

b23_ni.txt → FE-structure with mesh parameters

b23_i2.txt → constraints

b23_i3.txt → parameters for stress calculation

b23_i5.txt → surface constraints

In the beginning a new project must be created by using and Create Folder in this case e.g. *Example12*. To confirm this dialog, press *Enter* and close the dialog with *OK*. The Import of the geometry starts with Import/Export. At this moment a new context menu will be opened on the right side. Now you have to import the necessary files (*Figure 1*). Clicking the button Z88-File it is possible to load the different files. The file *b23_ni.txt* must be loaded with the option *Meshing-file z88ni.txt* and the following dialogue must be answered with *Yes*. These steps lead to a FE-mesh consisting of the 8 nodes plane stress element Nr. 7 (see also Z88 Aurora Theory Manual). To import constraints you must choose the *b23_i2.txt* file with the option *Boundary conditions z88i2.txt* in the Z88-File section. The stress parameters can be set if you import the file *b23_i3.txt* with the option *Stress parameters z88i3.txt.* Finally the file b23_i5.txt contains the surface loads. To import these use the option *Surface / Pressure loads z88i5.txt.*

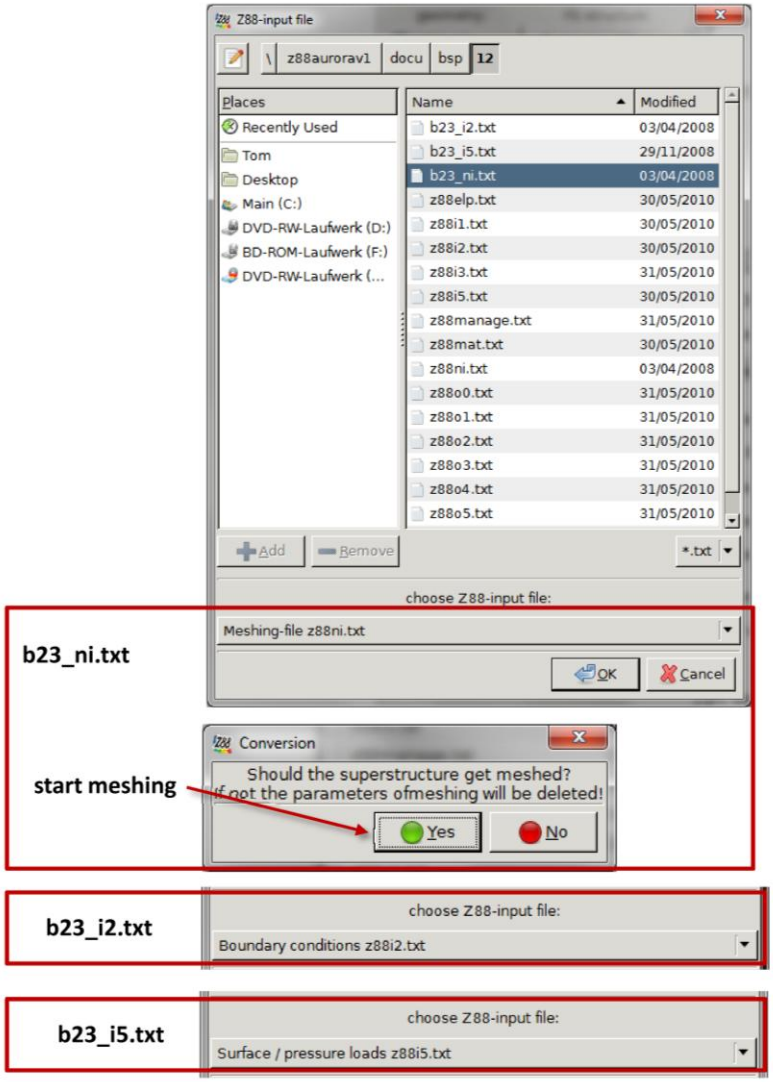


Figure 1: Import of files

To control the imported constraints use the button  to switch to the preprocessing mode and click on the load case with the name *case_1*. Now the applied constraints are shown in the 3D view (*Figure 2*).

You can start the solver by using the  button. The calculation can be done using the Cholesky-Solver (without renumbering) with *3x3(x3) Gauss points*. Set parameters for the stress calculation to *von Mises stresses* to be able to compare the calculated results with *Niemann (1965*) (*Figure 3*). To start the calculation, use the 

button.

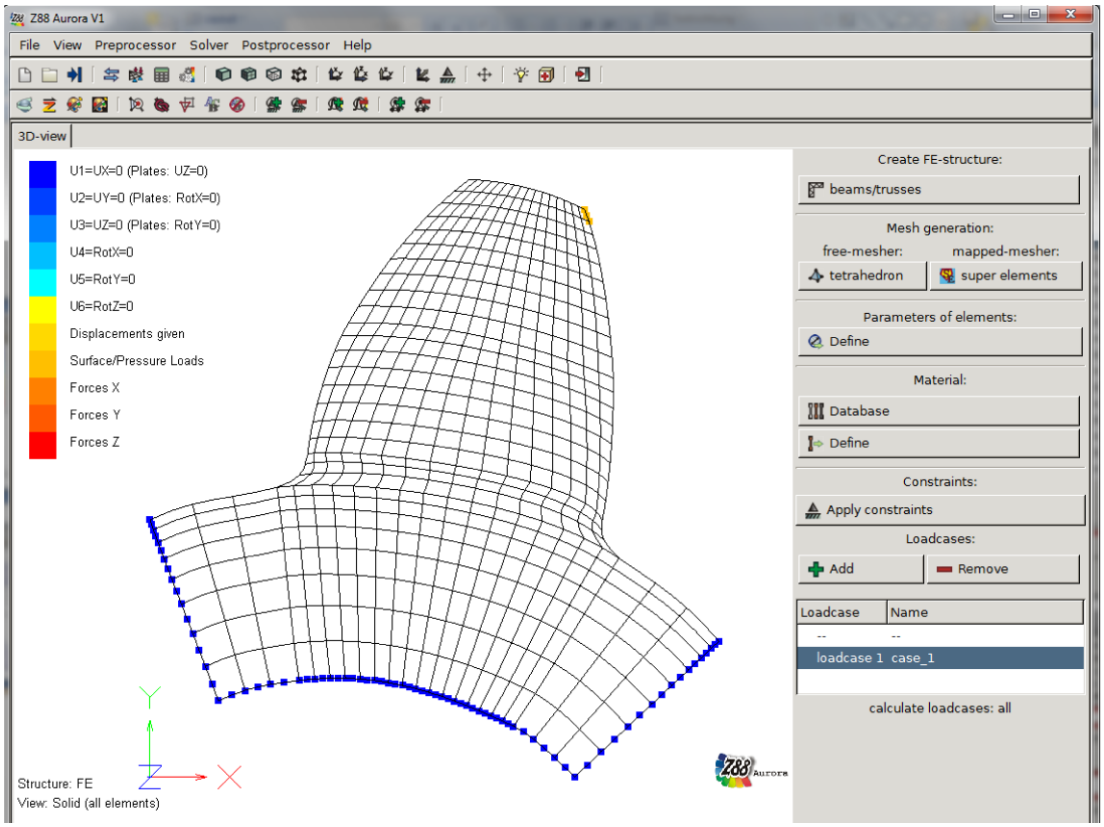


Figure 2: Model of a single gear tooth with applied constraints

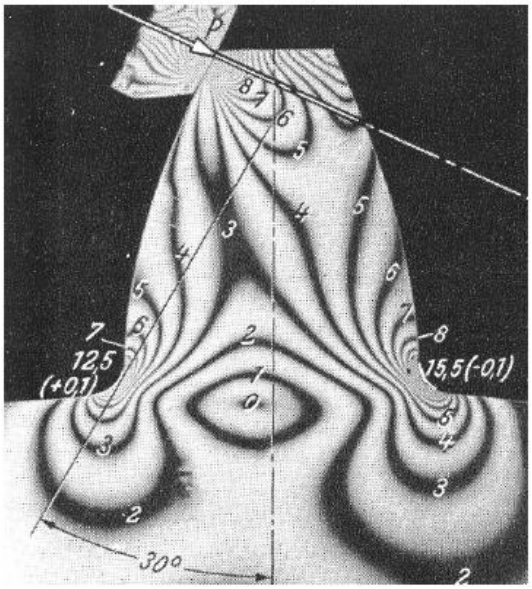


Figure 3: Stress-optical view after Niemann (1965): „The entered numbers 1 to 15,5 for lines of equal main shear stress are proportional to the stresses. The breakdown of one tooth is to be expected at the tension side of the tooth.“

The results can be shown in the postprocessor mode ( ) (*Figure 4*).

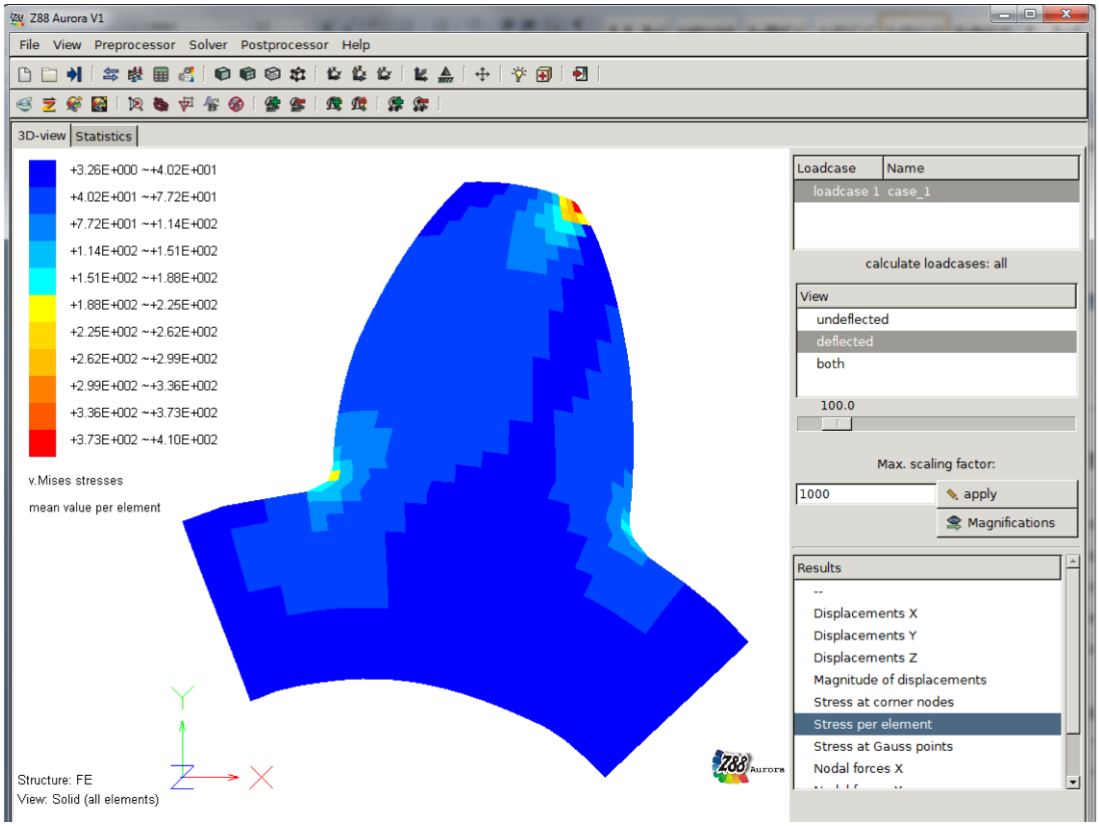


Figure 4: Results