

Part 16: Rolling Contact of a Rail-Wheel-Model with MEANS V10 and Add-On module Contact

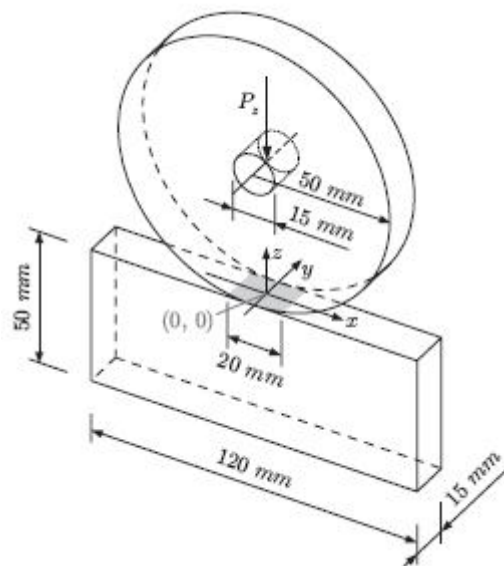
A wheel with an outer radius of 50 mm and an inner radius of 7.5 mm is pressed with a force of 214200 N perpendicular to a 120 mm railway track. Wheel and track are made of the steel S900A with a yield strength of 900 N/mm².

What is rolling contact

The recurrent exposure to high contact pressure tires the tracks by microstructural changes so far that fissures (Heat check cracks) occur. The phenomenon of rolling contact fatigue (Rolling Contact Fatigue RCF) is a significant cost factor for the manufacturer of train and rail systems or manufacturer of ball bearings or roller bearings.

Calculation with the Hertzian contact pressure for cylinder-plane:

The contact surface between the wheel and the rail is 15 mm wide and 20 mm long.



Geometry

Radius Cylinder

$R_{Zyl} = 50.00$ [mm]

Width contact surface

$b_{kf} = 15$ [mm]

Material

Young's modulus E

$E_{Mat} = 210000.00$ [N/mm²]

Load F prescribed

$F_k = 214200$ [N]

Results

semi contact width

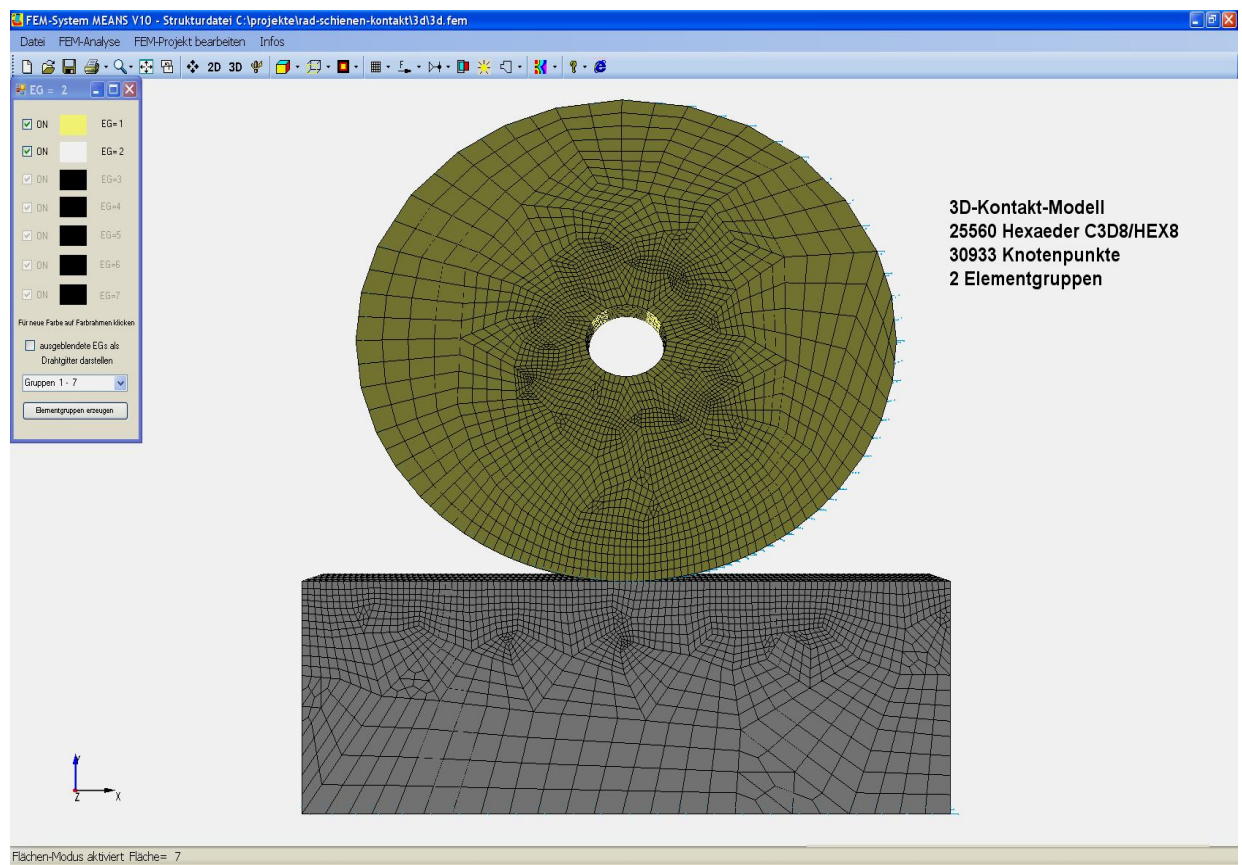
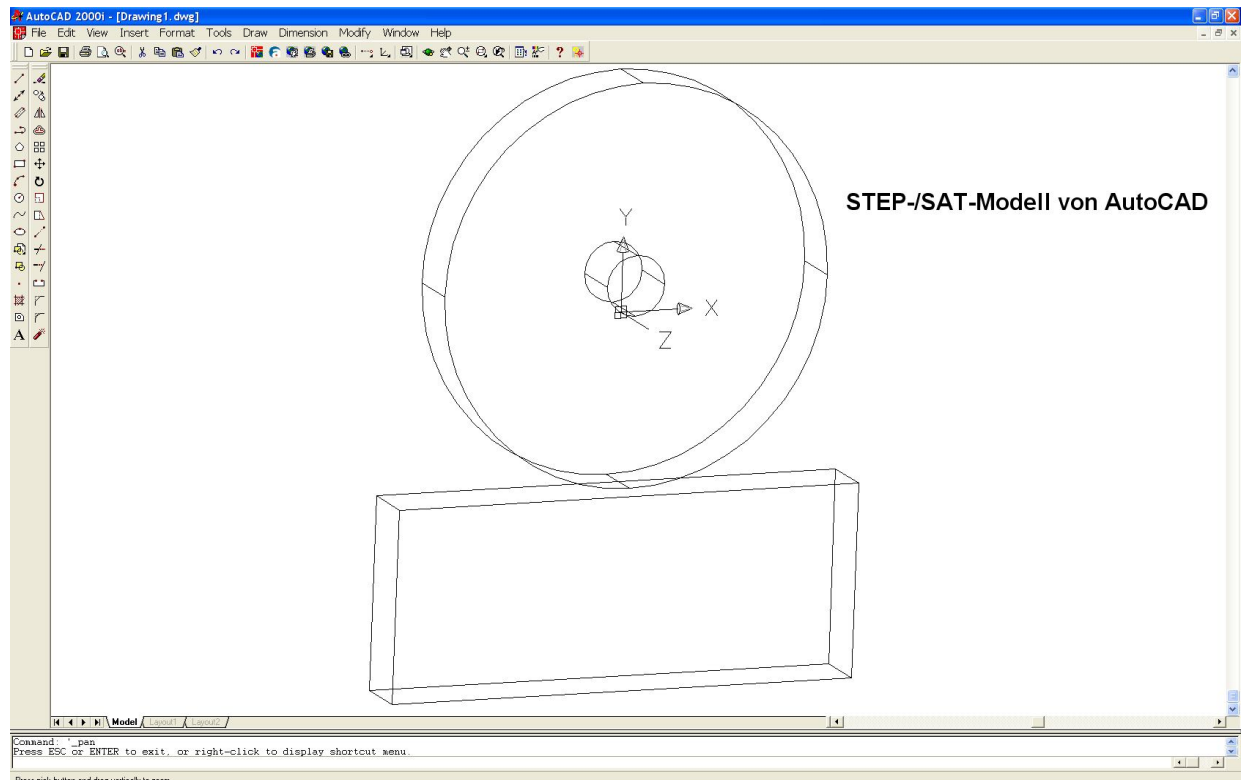
$a = 1.520 \cdot (F_k \cdot r_{Zyl} / (b_{kf} \cdot E_{Mat}))^{(1/2)}$
 $= 2.803$ [mm]

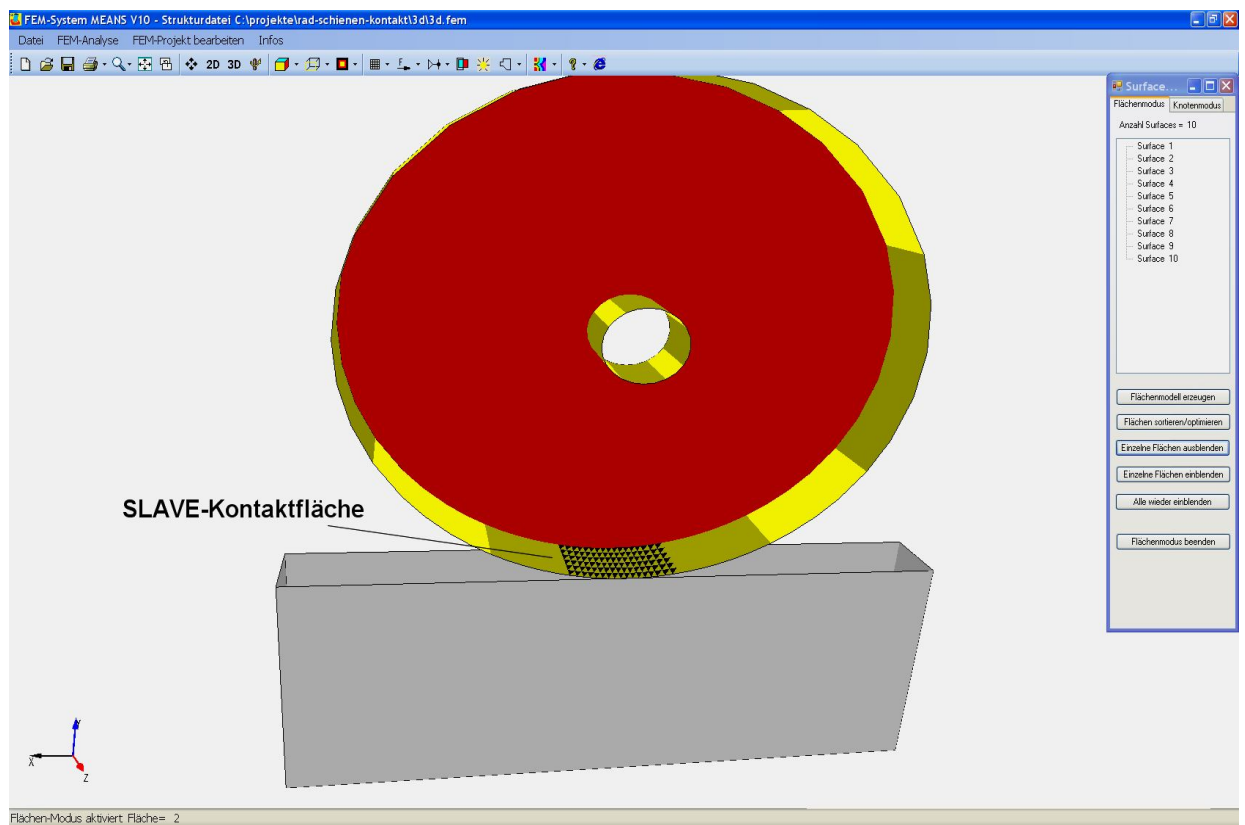
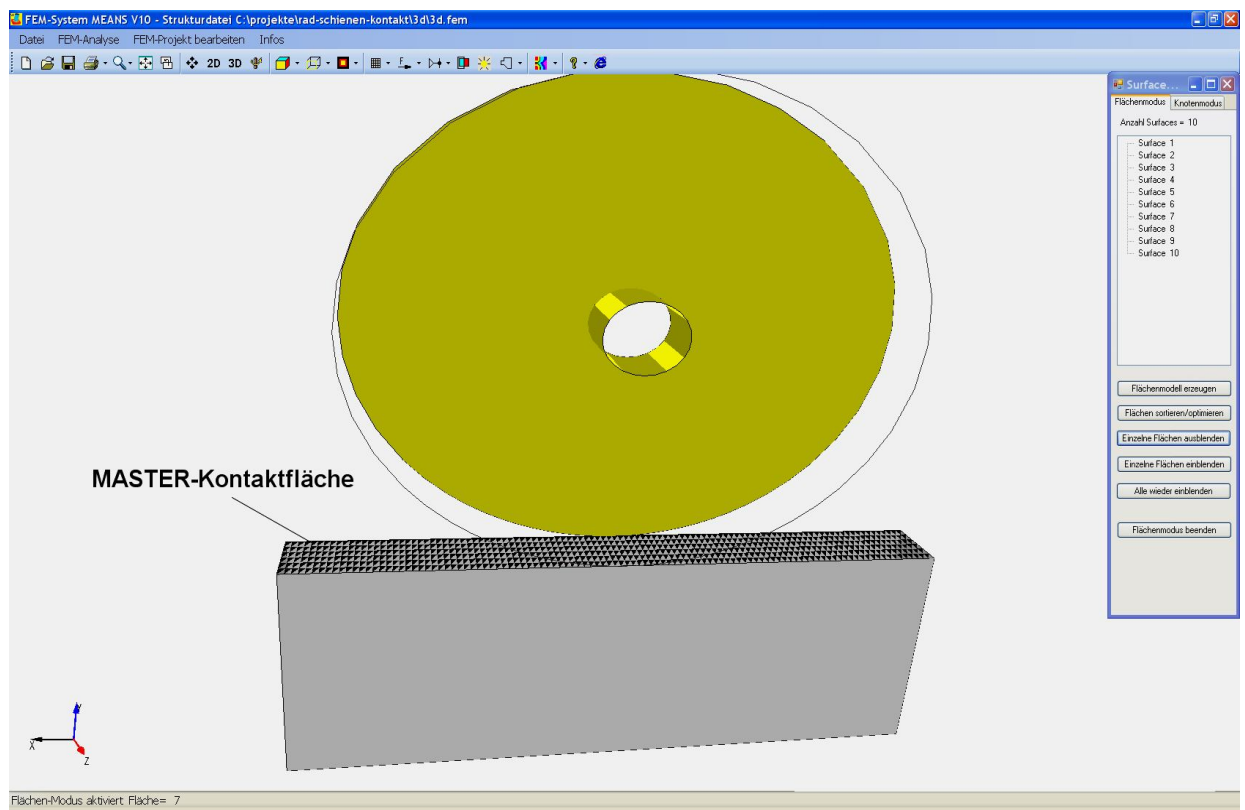
max. contact pressure

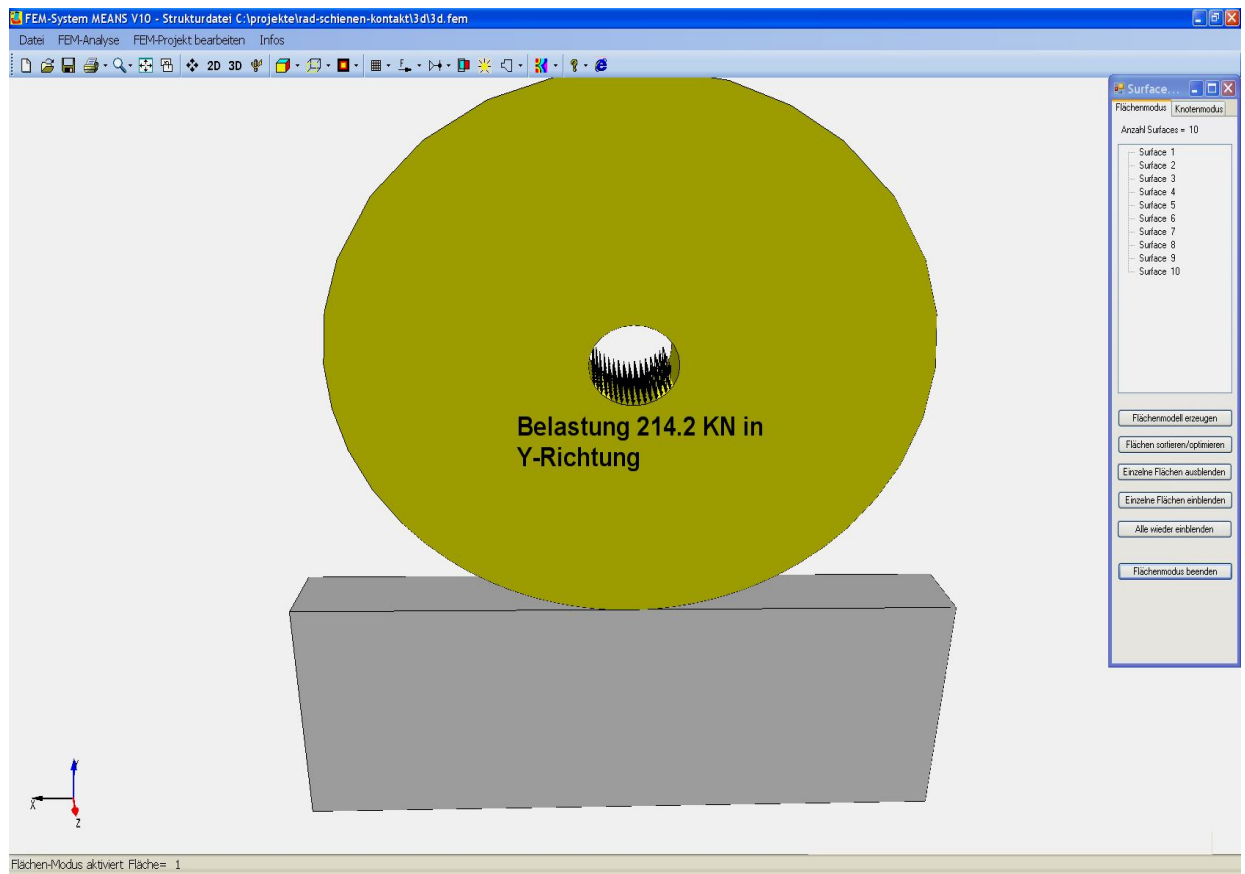
$\sigma_0 = 0.418 \cdot (F_k \cdot E_{Mat} / (b_{kf} \cdot r_{Zyl}))^{(1/2)}$
 $= 3237.166$ [N/mm²]

Using an online calculator calculated a contact pressure of 3237.16 N/mm².

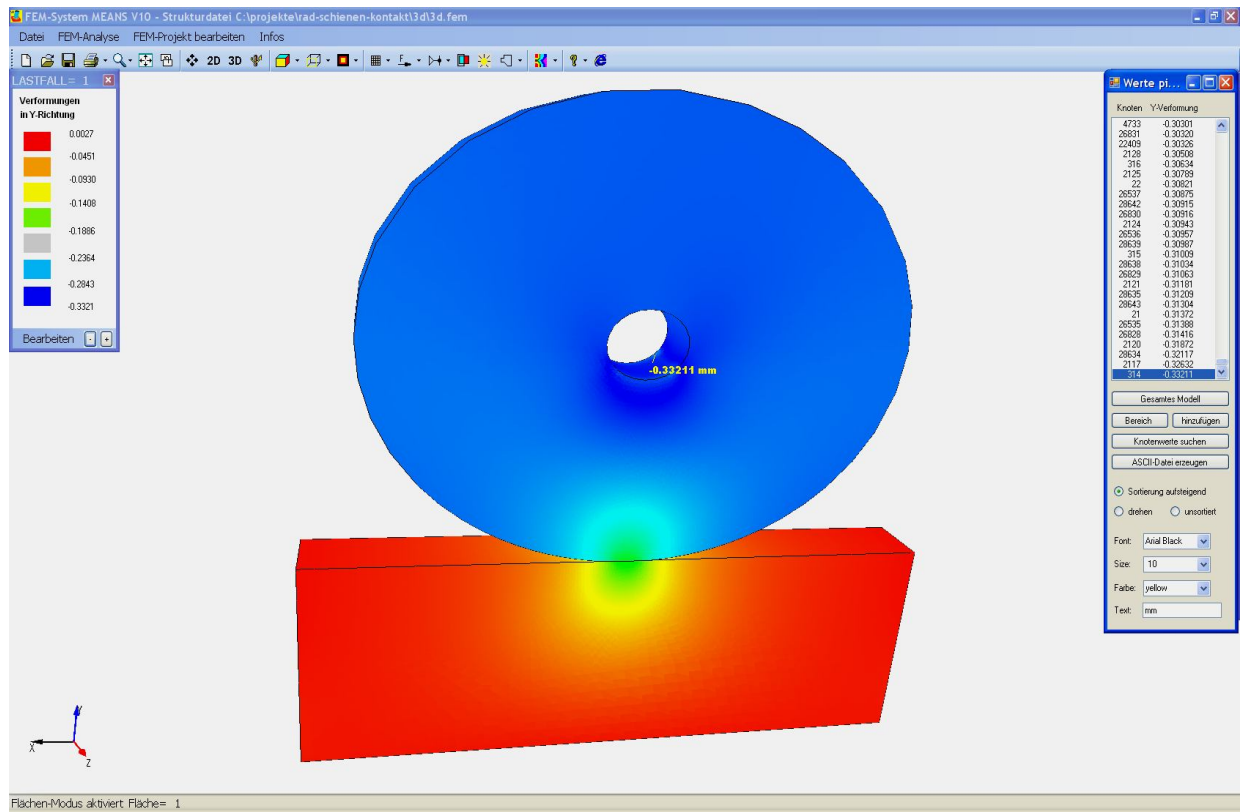
How big are the contact stresses with the FEM-System MEANS V10 with the add-on module CONTACT from HTA Software. Please request a free demo version under www.femcad.de



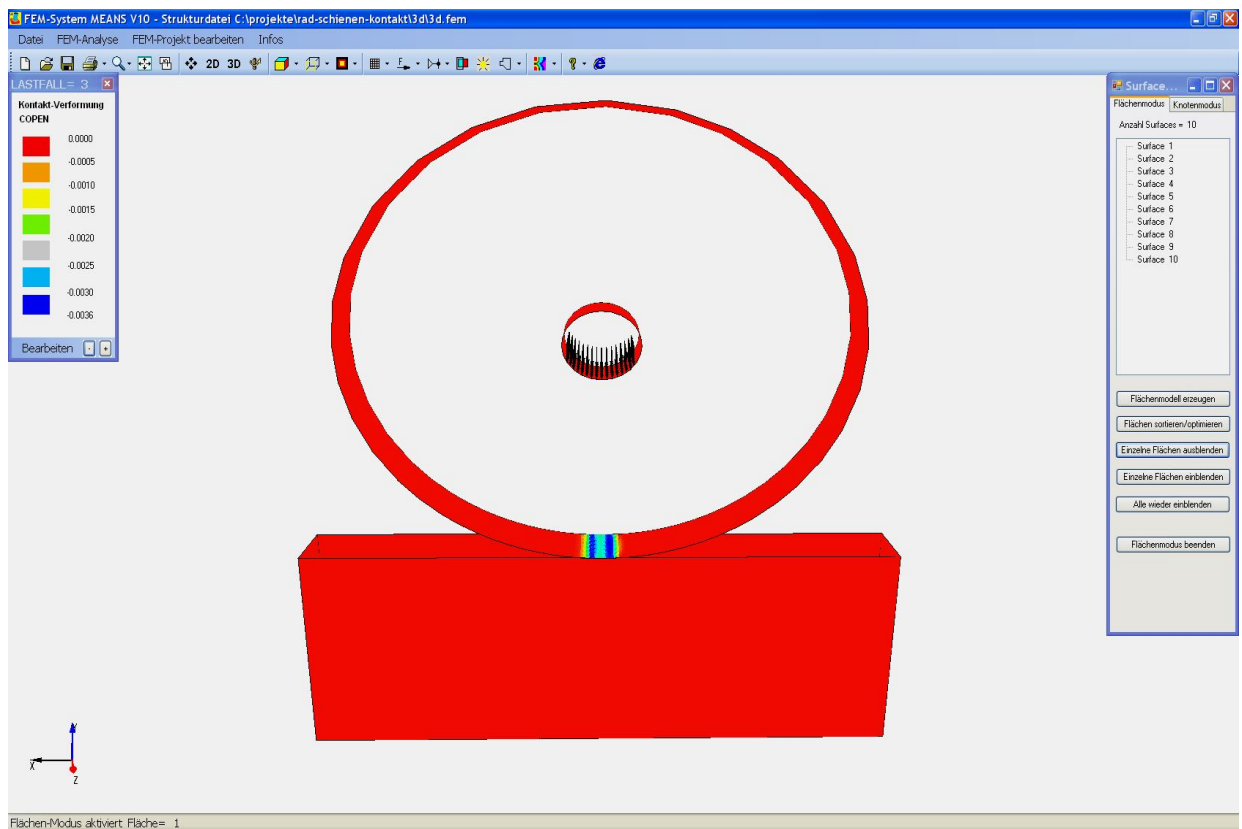




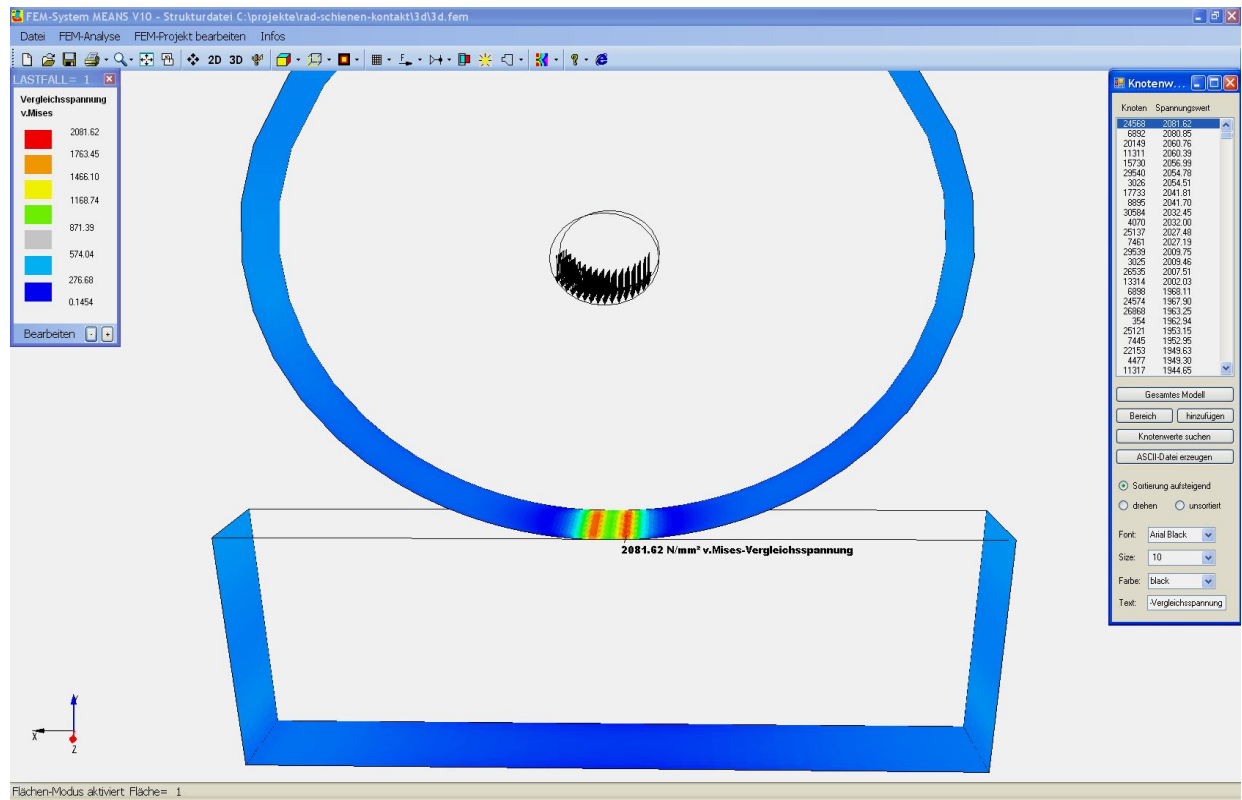
Y-Displacement FEM Model = - 0.3321 mm (exactly to (1) = - 0.34 mm)



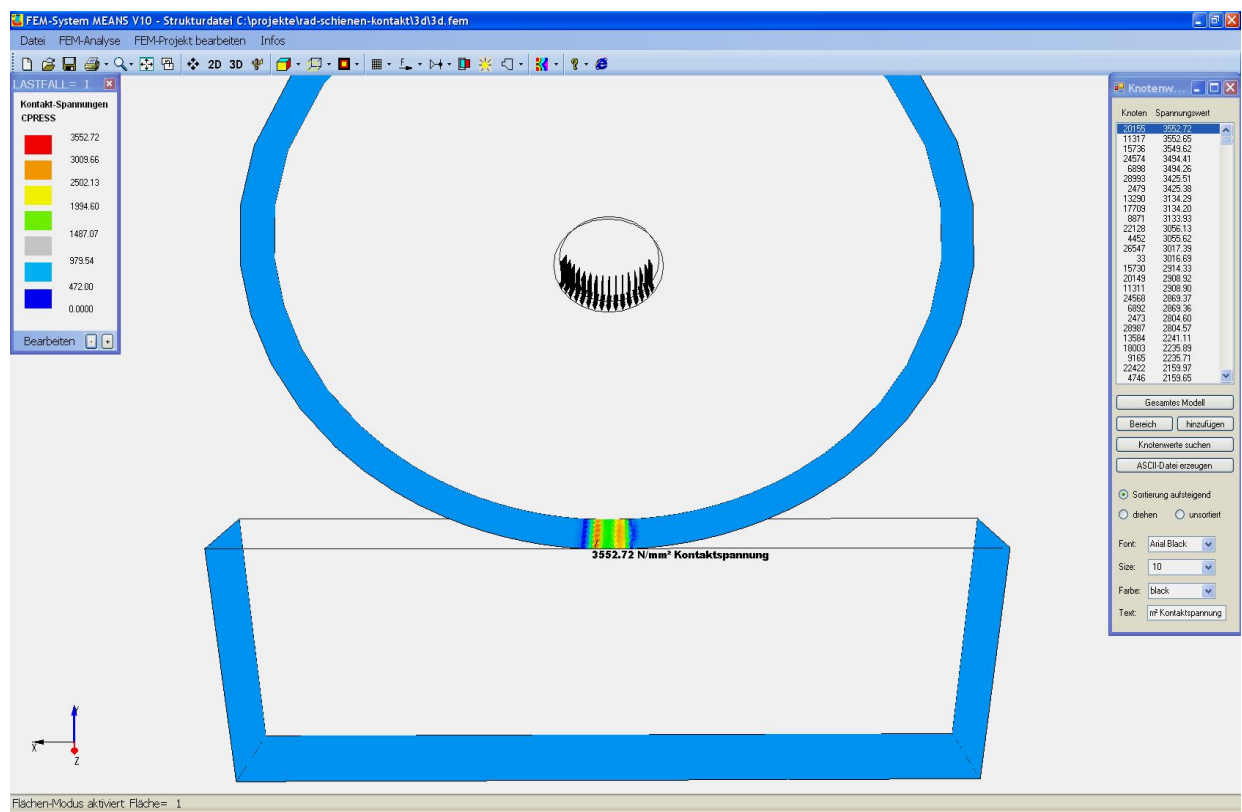
Y-Displacement Contact Surface = - 0.0036 mm (exactly to (1) = - 0.0044 mm)



v.Mises-Stresses = 2081 N/mm² (exactly to (1) = 2000 N/mm²)



Contact Pressure = 3552 N/mm² (exactly to (1) = 3237 N/mm²)



Literature

1. Zur Finite-Element-Modellierung des stationären Rollkontakts von Rad und Schiene von der Fakultät Bauingenieurwesen der Technischen Universität Dresden von SABINE DAMME aus Dresden. Berichte des Instituts für Mechanik und Flächentragwerke Heft4 (2006)