Avoiding self-loosening failure of bolted joints

Problem:
Fatigue and rotational self-loosening are the two most widespread reasons for failure of dynamically loaded bolted joints, especially due to external loading perpendicular to the bolt axis (transverse loading). More and more component systems show self-loosening in light weight design.

Solution:
The aim is to provide a method with Finite Element Analysis for detecting and understanding of the self-loosening process at bolted joints.
The computational results of the numerical simulation are compared with experimental investigations of the cyclic transverse load-displacement behaviour.

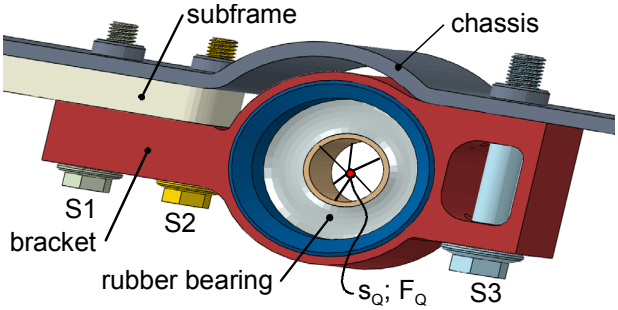
Advantage for user:
The self-loosening is influenced by several factors and the outcome is a result of their non-linear interactions. The numerical simulation includes the primary factors that cause loosening and provides a useful method for analysing details of fasteners loosening. A non-linear numerical simulation of the self-loosening of multi-bolted connections, even in the early development process, is possible.

Current publications:
G. Dinger, C. Friedrich, H. Kopfer, T. Gerhard, Self-loosening of bolted joints in lightweight design – computational design and prevention through constructive connection design, 38. Tagung des DVM-Arbeitskreises Betriebsfestigkeit, Clausthal-Zellerfeld, 2011, 69-85.

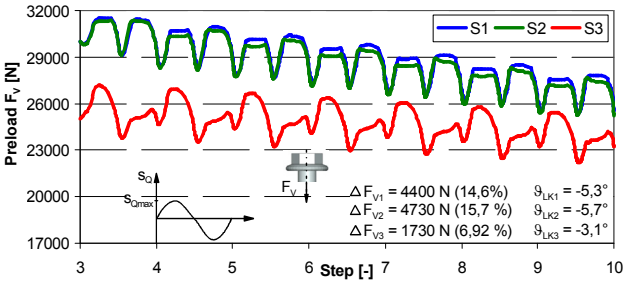
G. Dinger, C. Friedrich, Avoiding self-loosening failure of bolted joints with numerical assessment of local contact state, Engineering Failure Analysis 18, 2011, 2188-2200.

D. Koch, C. Friedrich, G. Dinger, Simulation of rotational self-loosening of bolted joints, NAFEMS Seminar: Simulation of Connections and Joints in Structures, Wiesbaden, 2010.

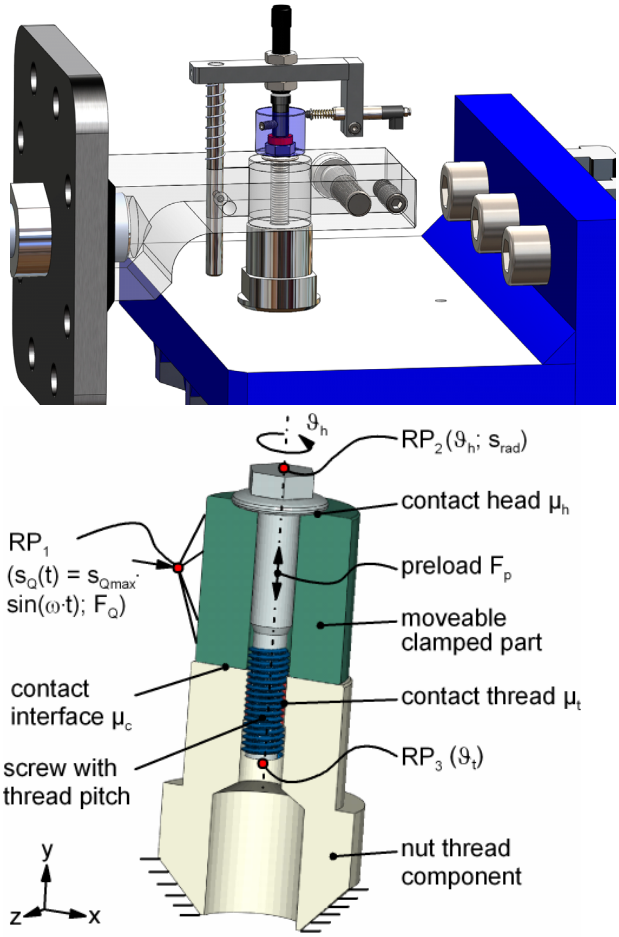
Contact person:
Georg Dinger
Tel.: +49-(0)271-740-4399
E-Mail: georg.dinger@uni-siegen.de



Three-dimensional finite element model for simulation of rotational self-loosening of multi bolted bracket



Preload loss F_V for screws S1, S2 and S3 due to rotational self-loosening



Verification of simulation results