FEM-Simulation of elasto-plastic deformations with contact

Jörg Frohne[1]

From the mathematical point of view modeling of elasto-plastic deformations of a solid with contact builds the main issue of my talk. Beside the appearance of external forces of friction and lubricant pressures the strains will be caused by a movable rigid obstacle. To take into consideration the history of loads, we use the Prandtl-Reuss-Law. The temporary changes of the stresses will be approximated by means of a Backward-Euler-Method. At every particular time this leads to a variational problem with nonlinear operator and nontrivial inequality conditions. Based on concepts of SQP-methods we design a robust, adaptive damped method for the handling of this continuous problem. This leads to a sequence of quadratic minimization problems, which will be efficiently solved via projection-techniques (CG-PSSOR) after Galerkin-discretisation on local refined FE-Grids.
Alternatively, it is possible to use a primal-dual active set strategy to solve the quadratic minimization problems. The advantage of this method is the possibility to parallelize the AMG preconditioner we used for this method, which is necessary to compute further more expensive, coupled simulations.

[1] University of Siegen, Mathematics, Siegen, Germany,
frohne@mathematik.uni-siegen.de