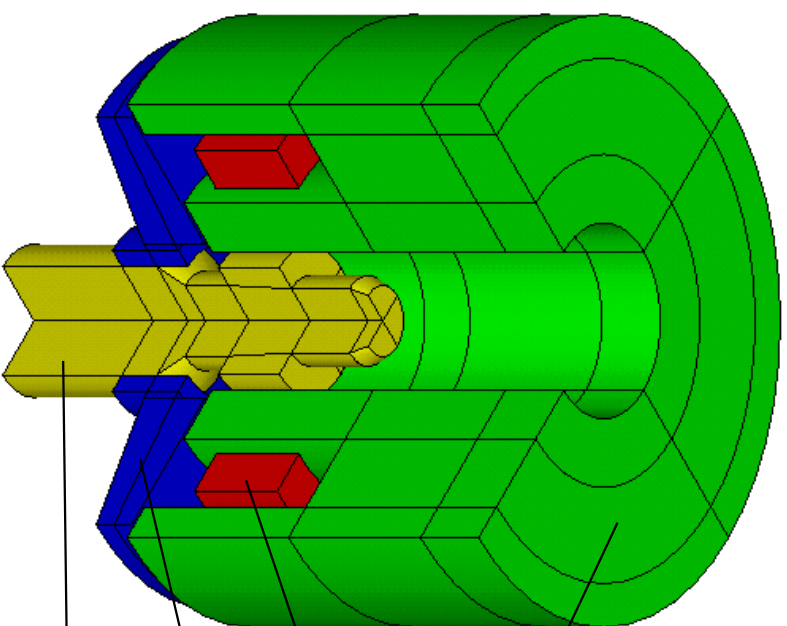
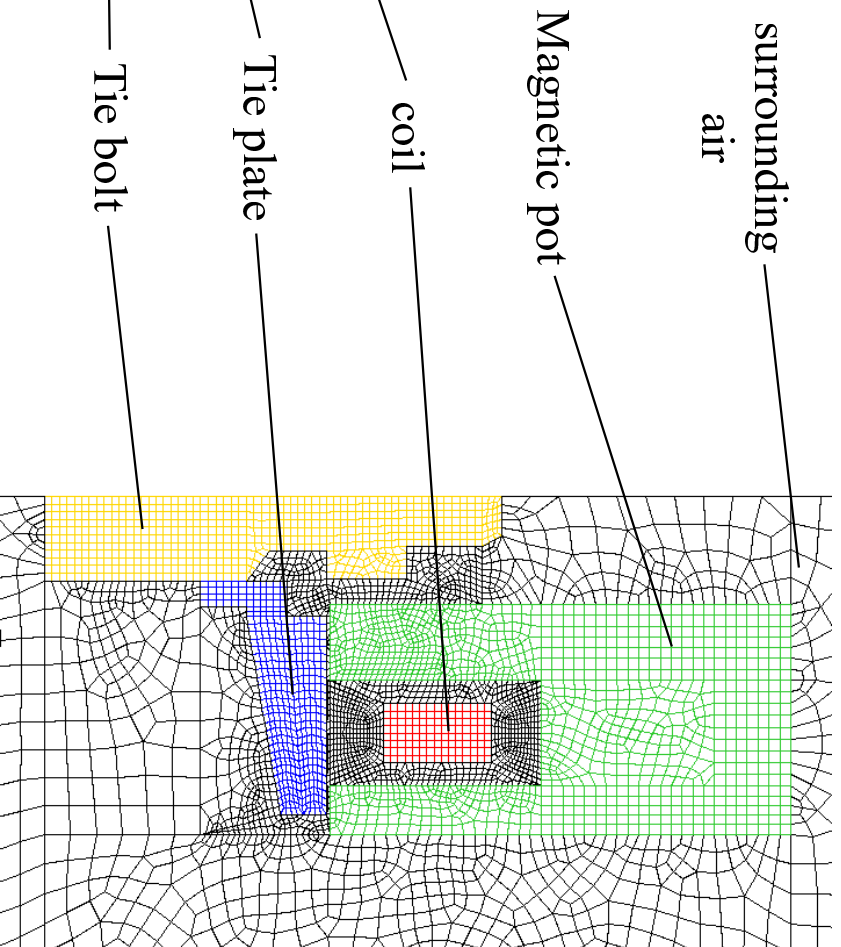


Simulation of a Solenoid Valve

Schematic



Detail of the FEM-Model



Problems in this simulation

- I. 3D-problem \Rightarrow Large number of unknowns
- II. Movement of the rotor \Rightarrow Mesh distortion (geometric nonlinearity)
- III. Nonlinear mechanical spring
- IV. Magnetic material nonlinearity



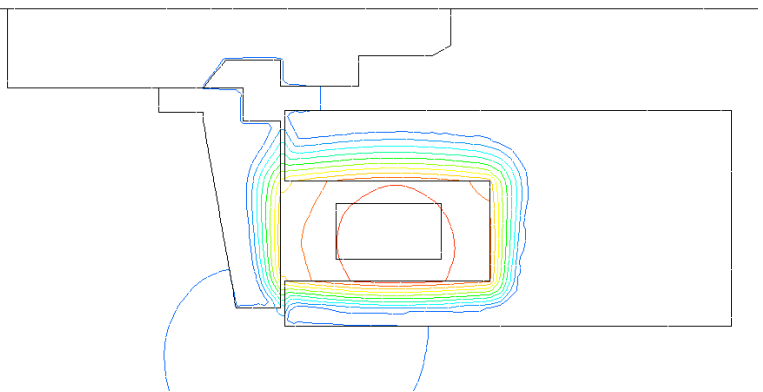
Solution with our software

- ad I. Efficient algorithms and iterative solvers
- ad II. Moving mesh algorithm
- ad III. Nonlinear spring-elements
- ad IV. Iterated solution based on energy functional and relaxations

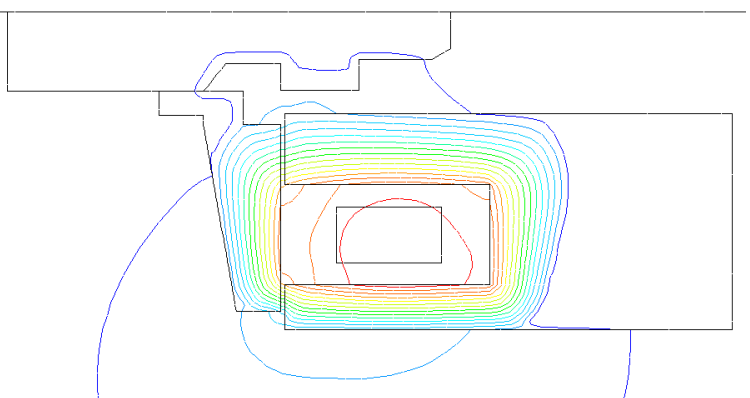
Results

Calculated Magnetic Field

after 50 s



after 100 s



Calculated position of the tie plate

