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Least - Squares FEM for nonlinear elasticity problems

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Elastic deformation processes play an important role in solid mechanics. In this talk, we consider nonlinear elastic behavior with a hyperelastic material law. Combined with the equations of equilibrium this forms a nonlinear first order system of partial differential equations for the displacement u and the first Piola - Kirchhoff stress tensor P. In order to solve this system, we consider a nonlinear least squares functional, which has to be minimized. For the minimization we use the iterative Gauss - Newton method, which results in a sequence of linear least squares problems.
For the finite element approximation of the associated variational problem we use quadratic Raviart - Thomas elements for the stress and continuous quadratic finite elements for the displacement. At the end of the talk we will give a numerical example and an outlook.