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Seminar über Fragen der Mechanik

zu folgendem Vortrag wird herzlich eingeladen

Montag, **30.06.2014, 14:15 Uhr**, Egerlandstr. 5, Raum 0.044

Implementation of Material Modeling Approaches at Finite Strains using a Highly Accurate Numerical Derivative Scheme

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Many materials as e.g. engineering rubbers, polymers and soft biological tissues, are often described by hyperelastic strain energy functions. For their finite element implementation the stresses and consistent tangent moduli are required and obtained mainly in terms of the first and second derivative of the strain energy function.

Depending on its mathematical complexity in particular for anisotropic media the analytic derivatives may be troublesome to be calculated or implemented. Then numerical approaches may be a useful alternative reducing the development time. Often-used classical finite difference schemes are however quite sensitive with respect to perturbation values and they result in a poor accuracy. The complex-step derivative approximation does never suffer from round-off errors, but it can only provide first derivatives.

A method which also provides higher order derivatives is based on hyper dual numbers. This method is independent on the choice of perturbation values and does thus neither suffer from round-off errors nor from approximation errors. Therefore, here we make use of hyper dual numbers and propose a numerical scheme for the calculation of stresses and tangent moduli which are almost identical to the analytic ones. Its uncomplicated implementation and accuracy is illustrated by some representative numerical examples.

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