Einladung zum Seminarvortrag im Aachener Mechanik & Statik Kolloquium

24. Juli 2017 | 13:30 Uhr

Sammelbau Bauingenieurwesen 2130,

Mies-van-der-Rohe-Str. 1; 52074 Aachen | 4. OG / ZS 414

RWTH AACHEN UNIVERSITY

„High Accuracy Numerical Methods and Their Applications in Engineering and Software Developments“

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High accuracy analyses are crucial for high-grade precision and sophisticated equipment. By the commonly used *h*-version finite element method (FEM), a great number of degrees of freedom is required even to obtain results with moderate accuracy. Therefore, the *p*-version FEM that is capable of providing results with high accuracy using only a few nodes is much more promising in high accuracy analyses than the *h*-version FEM. The *p*-version FEM was proposed in similar time as the *h*-version FEM or even earlier, and the promising properties of *p*-version FEM have attracted many researchers to study it for decades. The hierarchical finite element method (HFEM), the differential quadrature method (DQM) and its weak form, and more recently, the isogeometric analysis (IGA) can all be regarded as *p*-version methods. From the practical point of view, high-order solutions in complex geometries require high-order meshes and high-order post-processing, and high-order schemes always suffer from difficulties in numerical stability, boundary condition implementation, etc. These should be the reasons why they are not as prevalent as the low order schemes.

During the past years, we have solved the difficulties of HFEM and DQM in numerical stability, boundary condition implementation, etc. and have started to work on high accurate high-order mesh generation and post-processing. The high-order scheme developed by us is named as a differential quadrature hierarchical finite element method (DQHFEM) that is a combination of the HFEM with the DQM as indicated by the name and uses Fekete points on triangles, tetrahedrons, etc. The new method on triangular and tetrahedral domains is as accurate as the DQM or HFEM on quadrilateral on hexahedral domains. More importantly, the order of the basis in our method can be as high as needed and the results can almost reach computer accuracy. In the presentation, I will introduce triangular, quadrilateral, tetrahedral, triangular prism and hexahedral DQHFEM elements on curvilinear domains and their applications to analyses of solid structures, metallographic structures, polymer nanoparticle composites, etc. The aim is to shown that our method is capable of high accuracy local adaptive analyses without numerical stability and the time of developing commercial codes using high-order schemes for high accuracy large scale analyses of engineering problems has been ripe.

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