TROJÚHELNÍKY A ČTYŘSTĚNY INTEGROVANÉ V UZLECH:
APLIKACE NA PROBLÉMY DEFORMACE (TÉMĚŘ) NESTLAČITELNÝCH MATERIÁLŮ

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Linear simplex elements, in particular three-node triangles and four-node tetrahedra, are often introduced in textbooks only to be trashed a few pages later as too stiff and generally useless for modeling deformation of materials. Mixed finite element methods using these elements have been formulated to address locking in models of nearly incompressible media, but the excessive stiffness in bending typically remains. In the framework of displacement-based finite element models, (selective) reduced integration might be attempted, but due to the simplex character of these elements, element-based under-integration is not on option, and constraint counting suggests placing quadrature points at the nodes. Rules have been proposed to deal with the multi-valuedness of the strains at the nodes, and surprisingly viable formulations have emerged. In this talk we relate these ad hoc approaches with mesh-free methods, nonlocal elasticity, and assumed strain techniques showing how to design the present approach rationally from a strain-displacement formulation of the method of weighted residuals. A number of examples are presented to illustrate the performance in two-dimensional and three-dimensional elasticity of isotropic and anisotropic solids.

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