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# LINEAR SMOOTHING OVER ARBITRARY POLYTOPES FOR COMPRESSIBLE AND NEARLY INCOMPRESSIBLE LINEAR ELASTICITY

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**Abstract.** *We present a displacement based approach over arbitrary polytopes for compressible and nearly incompressible linear elastic solids. In this approach, a volume-averaged nodal projection operator is constructed to project the dilatational strain into an approximation space of equal or lower-order than the approximation space for the displacement field, resulting in a locking-free method. The formulation uses the usual Wachspress interpolants over arbitrary polytopes and the stability of the method is ensured by the addition of bubble like functions. The smoothed strains are evaluated based on the linear smoothing procedure. This further softens the bilinear form allowing the procedure to search for a solution satisfying the divergence-free condition. The divergence-free condition of the proposed approach is verified through systematic numerical study. The formulation delivers optimal convergence rates in the energy and $L^2$-norms. Inf-sup tests are presented to demonstrated the stability of the formulation.*