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Computational Modelling of Shells with Scale Effects

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This work deals with the computations of so-called geometrically exact shells with scale effects. This type of computations is relevant to thin-walled structures at small scales (e.g. thin films, nano tubes etc.). The shell formulation exhibits higher order gradients and is developed following some author's recent work on generalised continua. The framework has been modified as to account for two-dimensional surfaces as well. The shell formulation reduces to a standard one upon disregarding the higher gradient terms. The classical part of the formulation is a well known 7-parameter model previously developed by one of the authors which takes thickness change into account.
The numerical treatment is based on a meshfree formulation which provides the necessary C^1 continuity. As possible applications, dynamic buckling of cylindrical and spherical shells are investigated and some results for various states of loading and scale parameters are presented. The influence of the extra gradients is well demonstrated resulting in different buckling behaviour.

Keywords: Generalised continua, Strain gradient theory, Shell theory, Shell buckling, Scale effects, Meshfree methods