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HIGHER ORDER FINITE-ELEMENT MODELLING FOR CURVED INTERFACE PROBLEMS BASED ON STRAIGHT-EDGED N-SIMPLEXES AND POLYNOMIAL ALGEBRA

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Many Engineering and Bio-medical applications require accurate modelling of complex though smooth interfaces. An outstanding particular case is fluid-structure interaction, when the solid walls are curvilinear and hence the flow domain as well. As long as velocity and displacement finite-element representations of order higher than one are employed, the interface degrees of freedom must be properly interpolated, otherwise method's theoretical accuracy will be eroded. A simple approach is presented to avoid such a loss, based on a modification of classical variational formulations such as Galerkin's and GLS. In contrast to the isoparametric version of the finite element method [4], this technique allows for the use of polynomial trial- and test-fields, associated with straight-edged N-simplexes, thereby reducing significantly demands on numerical integration, especially for non linear problems. Examples with quadratic Lagrange finite elements to represent displacements and second-order methods to approximate the primitive variables of viscous incompressible flow, illustrate the efficiency of the proposed approach (cf. [1], [2] and [3]).

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