ON HIGH ORDER CURVED ELEMENTS

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High order Finite Element Methods require also high order geometry approximation. In this talk we discuss the construction of such high order curved elements for the two- and three-dimensional case.

An elegant way of managing high order geometry approximation is to associate the high order degrees of freedom for the geometry with the element edges and faces. By the construction of shape functions and coefficients corresponding to these degrees of freedom, one gets the desired mapping from the reference element to a global element. The question is how to obtain the coefficients and how to construct the shape functions. As there are a lot of shape function evaluations for higher p and many elements, one wishes fast computable shape functions. This is obtained by hierarchic polynomials.

In this talk a systematic way of constucting hierarchical shape functions is presented for two and three dimensions. It is relatively straight foreward for the tensor product elements square and brick, but it becomes trickier for trianglar, tetrahedral, prismatic and pyramidal elements. Here, the coefficients are determined by the solution of local Dirichlet problems. Finally, we present finite element computations and compare the accuracy for different types of geometry shape functions.