Generic construction of high order finite-element spaces

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In this talk we will discuss the implementation of a large range of high order finite-element shape functions. The construction principle closely follows the well known abstract definition as presented for example in the textbook on finite-elements by Ciarlet. Most notably the implementation often only requires the description of the nodal variables, the construction of the actual shape functions is carried out automatically.

In many cases the nodal variables can be generically implemented for a wide range of reference elements and polynomial degrees using the recursive construction of a set of reference elements as found in the DUNE software framework (www.dune-project.org). We have used this approach to implement different Lagrange type finite-element spaces, different DG spaces, and vector valued Raviart-Thomas type finite-elements. The automatic generation of the basis functions makes it easy to use different sets of nodal variables to describe the finite-element space. We will demonstrate the effectiveness of our approach by testing the conditioning and approximation quality of different versions of high order Raviart-Thomas type elements.

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