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A GENERAL OVERVIEW ON VIRTUAL ELEMENT SPACES

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Virtual Element Methods are a recent way to extend traditional Finite Element Methods to more general, polygonal and polyhedral, decompositions allowing hanging nodes and (almost) all sort of sinful behaviors. Compared to other previous extensions that have been on the market for some time (including generalized Barycentric Coordinates, Blending Functions, Partition of Unity Methods, Extended Finite Elements, and the like) Virtual Element Methods have the advantage of avoiding the use of numerical integration formulae, that for higher degree polynomials and complex geometries are not very much user-friendly. A positive side effect is that, in most applications, they allow the construction of methods that satisfy the *patch test* up to computer precision. Their main drawback is the fact that they contain (together with all the polynomials or vector-valued polynomials of a certain degree) functions that cannot be explicitly computed in closed form, as for instance the solutions of some suitable Partial Differential Equation at the element level. However, in practice, we never need to compute them, and we can get away with suitable, easily computable, approximations that do not deteriorate the *patch test*.