

# A subdivision-based implementation of the hierarchical b-spline finite element method

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## Abstract

A novel technique is presented to facilitate the implementation of hierarchical b-splines and their interfacing with conventional finite element implementations. The discrete interpretation of the two-scale relation, as common in subdivision schemes, is used to establish algebraic relations between the basis functions and their coefficients on different levels of the hierarchical b-spline basis. The subdivision projection technique introduced allows us first to compute all element matrices and vectors using a fixed number of same-level basis functions. Their subsequent multiplication with subdivision matrices projects them, during the assembly stage, to the correct levels of the hierarchical b-spline basis. The proposed technique is applied to convergence studies of linear and geometrically nonlinear problems in one, two and three space dimensions.

*Keywords:* Finite elements, hierarchical b-splines, subdivision schemes

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