

Numerical Analysis and PDE

The bubble transform: A new tool for analysis of finite element
methods

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We will discuss the construction of a linear operator, referred to as the bubble transform, which maps scalar functions defined on $\Omega \subset \mathbb{R}^n$ into a collection of functions with local support. In fact, for a given simplicial triangulation \mathcal{T} of Ω , the associated bubble transform $\mathcal{B}_{\mathcal{T}}$ produces a decomposition of functions on Ω into a sum of functions with support on the corresponding macroelements. The transform is bounded in both L^2 and the Sobolev space H^1 , it is local, and it preserves the corresponding continuous piecewise polynomial spaces of all degrees. As a consequence, this transform is a useful tool for analysing finite element methods. Important applications are the construction of local projection operators which are uniformly bounded in the polynomial degree, and the study of condition numbers of local bases and frames.

This is joint work with Richard S. Falk