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CURVED ELEMENTS IN THE FINITE ELEMENT METHOD

by MILOŠ ZLÁMAL

The finite element method is the Ritz—Galerkin method using special subspaces of trial functions. The main feature of these subspaces consists in that the basis functions vanish over all but a fixed number of elements into which the given domain is divided. The triangular elements are the elements very often used by the engineers for solving boundary value problems in two variables. The reason consists obviously in that it is easy to approximate an arbitrary boundary by a polygon and to triangulate the polygonal domain. If we use piecewise linear functions as trial functions the approximation of the boundary by a polygon is a natural one. However if we use functions which are piecewise polynomials of a higher degree we cannot expect that we retain the same accuracy along the curved part of the original boundary as inside the domain or along the polygonal part of the boundary. We propose curved elements which are a natural generalization of the triangular elements. They make possible, easily from the computational point of view, to construct finite dimensional spaces of trial functions which are subspaces of the energy spaces of second order boundary value problems in arbitrary plane domains. In the lecture there are introduced results justifying the curved elements. Error bounds are given and the problem of the best strategy for numerical integration of element stiffness matrices is investigated. All these results are described in detail and proved in two papers which will appear in SIAM Journal on Numerical Analysis.

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