

## Moving Finite Element Method-a Local Meshless Formulation

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**Abstract:** A novel discretization method is proposed and developed for numerical solution of boundary value problems governed by partial differential equations. In contrast to the standard Finite Element Method (FEM), the analyzed domain is not covered by a mesh of fixed non-overlapping finite elements, but only a net of nodes is used for discretization. Around each node, there is properly created a Lagrange finite element and the spatial variation of field variables is interpolated within this element in terms of nodal values and polynomial shape functions defined in the intrinsic coordinate space of the finite element. Thus, the Lagrange finite element associated with a node is moving within the analyzed domain from node to node. Since there are no element interfaces known in standard FEM with a fixed finite element mesh, there are eliminated the difficulties with continuity of derivatives of field variables on such interfaces and higher order derivatives are available within the moving finite element. This makes the Moving Finite Element (MFE) approximation to be applicable also to the development of the strong formulation of a boundary value problem with collocation of both the governing equations and boundary conditions at interior and boundary nodes, respectively. Besides the strong form also the local weak form can be developed with consideration of the governing equations in weak sense on local subdomains around each interior node. Since the local subdomain is involved inside the considered moving finite element, the MFE approximation is applicable to interpolation of field variables and their derivatives on local subdomain. The resulting system matrix of discretized equations is sparse. The reliability (accuracy and stability) and efficiency of the new method has been verified in numerical simulations for 2D problems of heat conduction in solids with possible continuous gradation of the heat conduction coefficient.

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