

PARTITION OF UNITY ISOGEOMETRIC
ANALYSIS FOR SINGULARLY PERTURBED
PROBLEMS AND FOURTH ORDER
DIFFERENTIAL EQUATIONS CONTAINING
SINGULARITIES

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Preprint no. 2016-14

Abstract

Our aim in this research is to develop the numerical solutions of singularly perturbed convection-diffusion problems and heat equations in a circular domain, and fourth-order PDEs containing singularities, avoiding fine mesh around the boundary layer and singular zone. To resolve the oscillations of classical numerical solutions of our problems, we develop boundary layer elements via boundary layer analysis for the perturbed problem. To capture singularities on the crack domain, we also construct singular functions by Mapping Method for the fourth-order equations containing singularities. We modify the boundary layer elements and singular functions using partition of unity function with flat-top, which absorb the boundary layer and crack singularities and do not affect outside the boundary layer zone and singular zone. Using B-spline Isogeometric Finite element space enriched with the boundary layer elements and singular functions, we obtain an accurate numerical scheme on the exact geometry, in a circular domain.