The authors present a technique for binary recovery based on the phase field methodology. It is proved that the method ensures that the solutions exist, and that the forward problem remains well posed for them. The technique is validated with a Γ-convergence of the phase field regularization to a perimeter penalization technique. A mixed formulation of the problem is established, and shown that minimizers of this solve the original problem. A convergent discrete formulation relying on a monotone finite difference is constructed for the forward problem whereas a mixed finite element method for the inverse problem is used. Some numerical tests are presented to demonstrate the effectiveness and scalability of the proposed method and ability to solve large-scale problems.

Reviewer: Abdallah Bradji (Annaba)

MSC:

65M32 Numerical methods for inverse problems for initial value and initial-boundary value problems involving PDEs
65M30 Numerical methods for ill-posed problems for initial value and initial-boundary value problems involving PDEs
65M60 Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs
65M06 Finite difference methods for initial value and initial-boundary value problems involving PDEs
65K10 Numerical optimization and variational techniques
65M12 Stability and convergence of numerical methods for initial value and initial-boundary value problems involving PDEs
65J20 Numerical solutions of ill-posed problems in abstract spaces; regularization
35F21 Hamilton-Jacobi equations
35D40 Viscosity solutions to PDEs
86A15 Seismology (including tsunami modeling), earthquakes

Keywords:
seismic tomography; binary recovery; phase field; finite elements; eikonal equation

Full Text: DOI arXiv Link

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