

# Fast Numerical Methods for Interface Problems with Applications to Image Processing and Inverse Problems

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## ABSTRACT

Many real application problems need efficient tools for interface processing. For image processing, image segmentation, surface and edge detection need to find interfaces from digital images. Optimal shape design problems need to find the optimal location of surfaces and curves. Many inverse problems and image construction applications need to find functions and shaped related to surfaces and curves. Level set method is one of the most powerful tool in dealing with these kind of applications. We shall first give an overview of the tradition level set methods. Then, we proposed some variants of the level set methods which avoid some of the numerical difficulties associated with the traditional level set techniques. In the end, we present some of our recent research results in using these methods for image processing and inverse problems for coefficient identification and oil reservoir simulations. Especially, we shall show the fast methods related to graph cut type of maximum flow problems can be used to get fast numerical schemes for this kind of applications. Maximum flow/min-cut ideas have been widely used for computer networks and computer vision. We now show that they can also be used to solve some partial differential equations.

## REFERENCES

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