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A Level Set Reinitialisation Routine Suitable for Use on Unstructured Grids

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Introduction

The study of segregated fluid flows on digital computer has progressed steadily for the last 50 years. Despite many advances, scientists and engineers still have many challenges to overcome. One such challenge is accurate, efficient simulation of breaking waves. The goal of this PhD project is to develop a level set free surface tracking method with re-distancing procedure for use on unstructured grids. The result will be an accurate means to track water/ air interfaces on a variety of types of numerical grid. The method will be used in a segregated flow solver using a Cartesian cut cell numerical grid that is being developed in the Institute for Energy Systems.

Objectives

- 1. Author a 2D Cubic Polynomial Interpolation (CIP) [1] advection solver for testing purposes.
- 2. Demonstrate level set reinitialisation method [2] in 2-dimensions using a 1st order upwind gradient approximation.
- 3. Develop and demonstrate a level set reinitialisation method using a high order upwind gradient approximation that is compatible with unstructured numerical grids.



Fig 1, Level set redistancing in 2-dimensions



Fig 3. Advection with redistancing comparison

Progress

- All 3 main objectives have been successfully satisfied.
- Further analysis required for thesis is being conducted.
- Thesis of the project is currently being compiled.

References

1. Yabe et al., The Compact CIP (Cubic-Interpolated Pseudo-Particle) Method as a General Hyperbolic Solver, Computers & Fluids, 1991, 421-431

2. Sussman et al., A Level Set Approach for Computing Solution to Incompressible Two-Phase Flow, Journal of Computitional Physics, 1994, 146-159

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