

Unsteady Advection-Diffusion Problem

Ryan Grove

Department of Mathematical Sciences
Clemson University

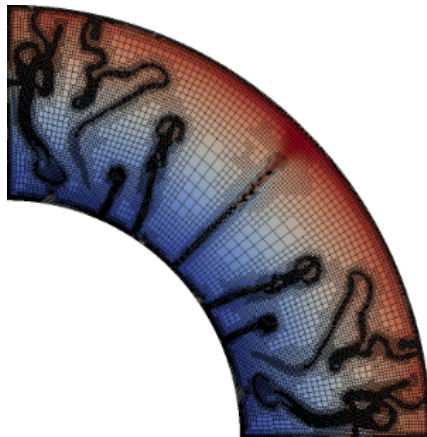
Advisor: Dr. Timo Heister

deal.ii Hackathon, 2015



Introduction to ASPECT

Advanced Solver for Problems in Earth's ConvecTion.



- ASPECT is a code to simulate problems in thermal convection.
- Main idea of ASPECT is to convince the geoscience community using modern numerical methods.

From: <http://dealii.org/aspect/>

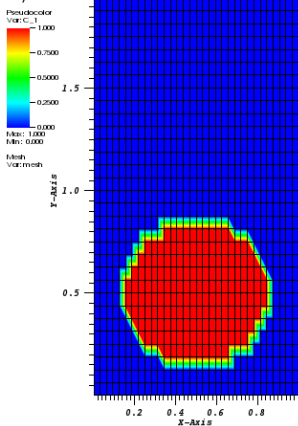


Motivation for Research

Composition field in a heated rising bubble form.

DB: solution-00000.pvtu

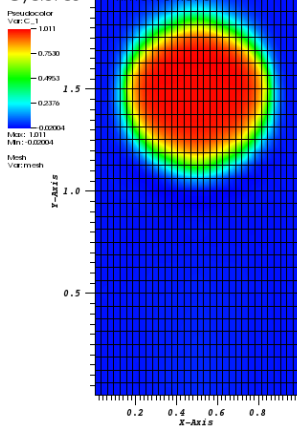
Cycle: 0



Start

DB: solution-00063.pvtu

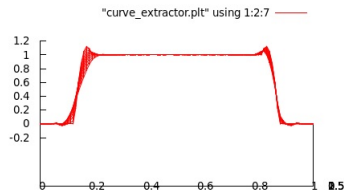
Cycle: 63



End



What is the Problem?



Objective:

The rising bubble should look exactly the same when it is done being displaced as it does at the very beginning.

Things that go wrong:

- **D**iffusion - Should be a rectangle
- **O**vershoots - Should be no higher than 1
- **U**ndershoots - Should be no lower than 0



What is the Problem?

It is difficult to minimize overshoots and undershoots without creating too much smear.

- We decided to look into SUPG, dCG91, and Entropy Viscosity schemes and compare them using stationary and non-stationary test equations.
- The goal of this work is to ultimately find a replacement to the scheme currently used in ASPECT (if needed).

