

Milestone 1

Milestone 1: Results and Analysis

Details how to run the first milestone of the MADDs project in 2D and 3D and provides some results of these simulations. It also gives the rates of convergence of the pressure gradient solutions as the resolution is increased.

Running the code

In order to run the simulations for milestone 1 of the MADDs project (in 2D), first:

```
cd Magma/Models/Milestone1/Ridge2D_Quadratic
```

Then make a symbolic link to the executable binary (assuming the code has been successfully built):

```
ln -s ../../../../../../build/bin/StGermain .
```

The simulation may then be run (in parallel), passing in the respective XML file as input:

```
mpiexec -np <# of procs> ./StGermain Ridge2D.xml
```

Alternatively, the 3D simulation may be run as:

```
cd Magma/Models/Milestone1/Ridge3D_Quadratic
ln -s ../../../../../../build/bin/StGermain .
mpiexec -np <# of procs.> ./StGermain Ridge3D.xml
```

Simulation results and error convergence

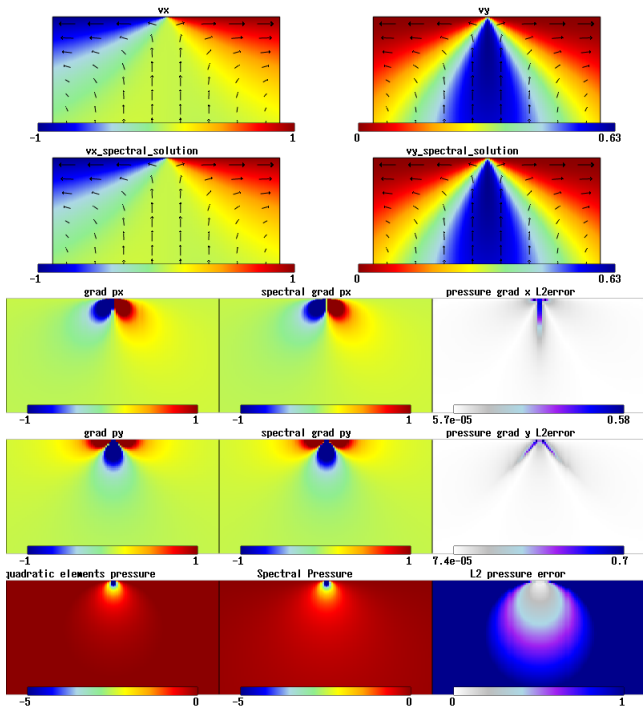
These simulations will produce graphical output of the velocity, pressure and pressure gradient solutions, as well as the analytic reference solutions and the element-wise normalised L2 error

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fields for the pressure and pressure gradients, as shown below. It will also generate text files to the output directory giving the node-wise results for the respective fields.

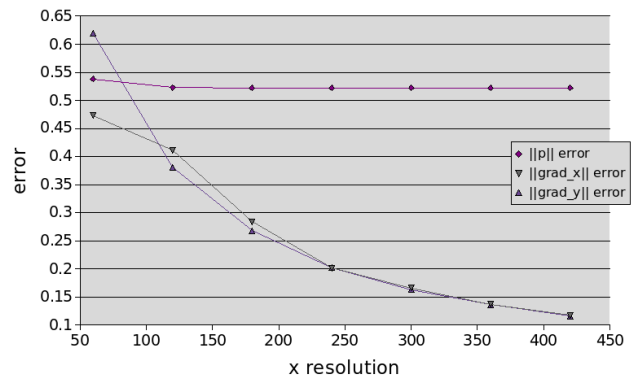
As the resolution is increased, the normalised global L2 errors are observed to decrease. This decrease is approximately linear for the 2D ridge model and slightly poorer for the 3D model. Graphs detailing the global errors as a function of resolution are given below.

2D Ridge Model



Velocity, pressure and pressure gradients solutions and L2 errors for a 2D ridge model with 120 x 60 elements.

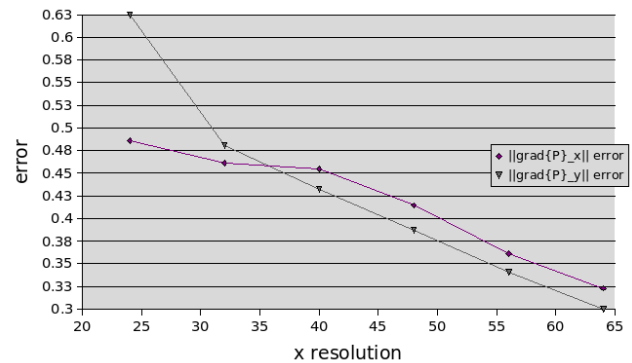
Global L2 Errors



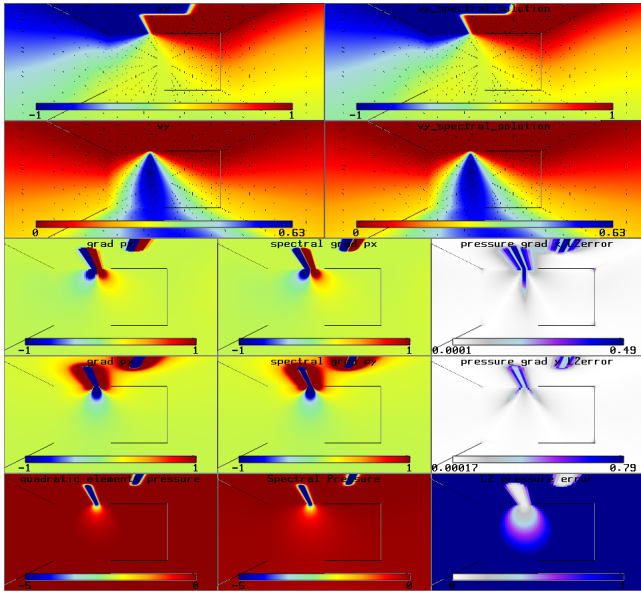
Global Pressure Gradient Errors for 2D Ridge Model. Normalised global L2 errors.

3D Ridge Model

Global L2 Errors - 3D Ridge Model



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Velocity, pressure and pressure gradient solutions and L2 error fields for 3D ridge model. Model. Global Pressure Gradient Errors for 3D Ridge

Global normalised L2 pressure gradient errors at varying resolutions.