A Novice Uses FEniCS

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Who I am

- Second year graduate student in Computer Science,
- BS in Physics/Math, BA in Philosophy,
- Very new to programming,
- New to FEM,

My Problem

Test out some different Finite Elements in FIAT for some mixed methods.

- Learn about Convergence rates,
- Check the error of different finite element,
- Give a head to head comparison on what elements work better.

How FEniCS works well

- Powerful scripting style environment,
- Quick introduction to standard problems,
- Nice modular interfaces,
- Limited knowledge required to use,
- Rather easy to start changing things.

Some Difficulties w/ Dolfin mostly

- Documentation
  - Where to go for help?
  - Where to learn about new ways of doing things?
- Programming Petsc or not?
  - Problems with Matrix/Vector wrappers.
  - Limited set of Petsc functionality
- Coding Conventions
  - Should this code be added?
  - Does the code look right?

Results

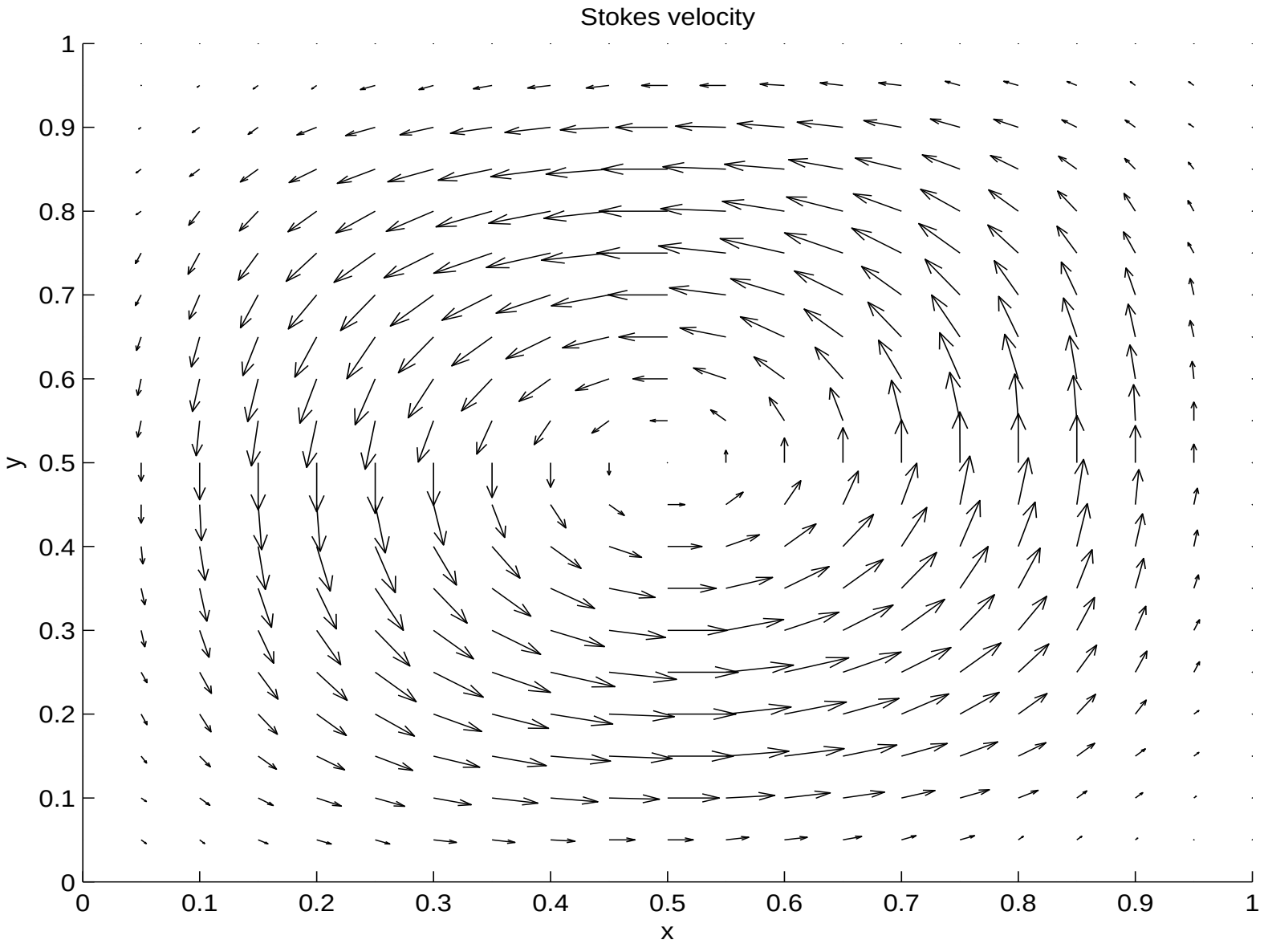
For Stoke equations, with an easy to solve u:

$$\begin{aligned} -\Delta u + \nabla p &= f \\ \nabla \cdot u &= 0 \end{aligned} \quad , \qquad u = \begin{bmatrix} \sin(\pi x)\cos(\pi y) \\ -\cos(\pi x)\sin(\pi y) \end{bmatrix}$$

Using Taylor-Hood elements,

Number of Iterations		
mesh($n \times n$)	P1 & P2	P2 & P3
4	14	22
8	24	54
16	83	283
32	328	1319

Plot



Closing

Any Questions?