Numerical solution of PDEs using the Finite Element Method

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FRIEDRICH-ALEXANDER
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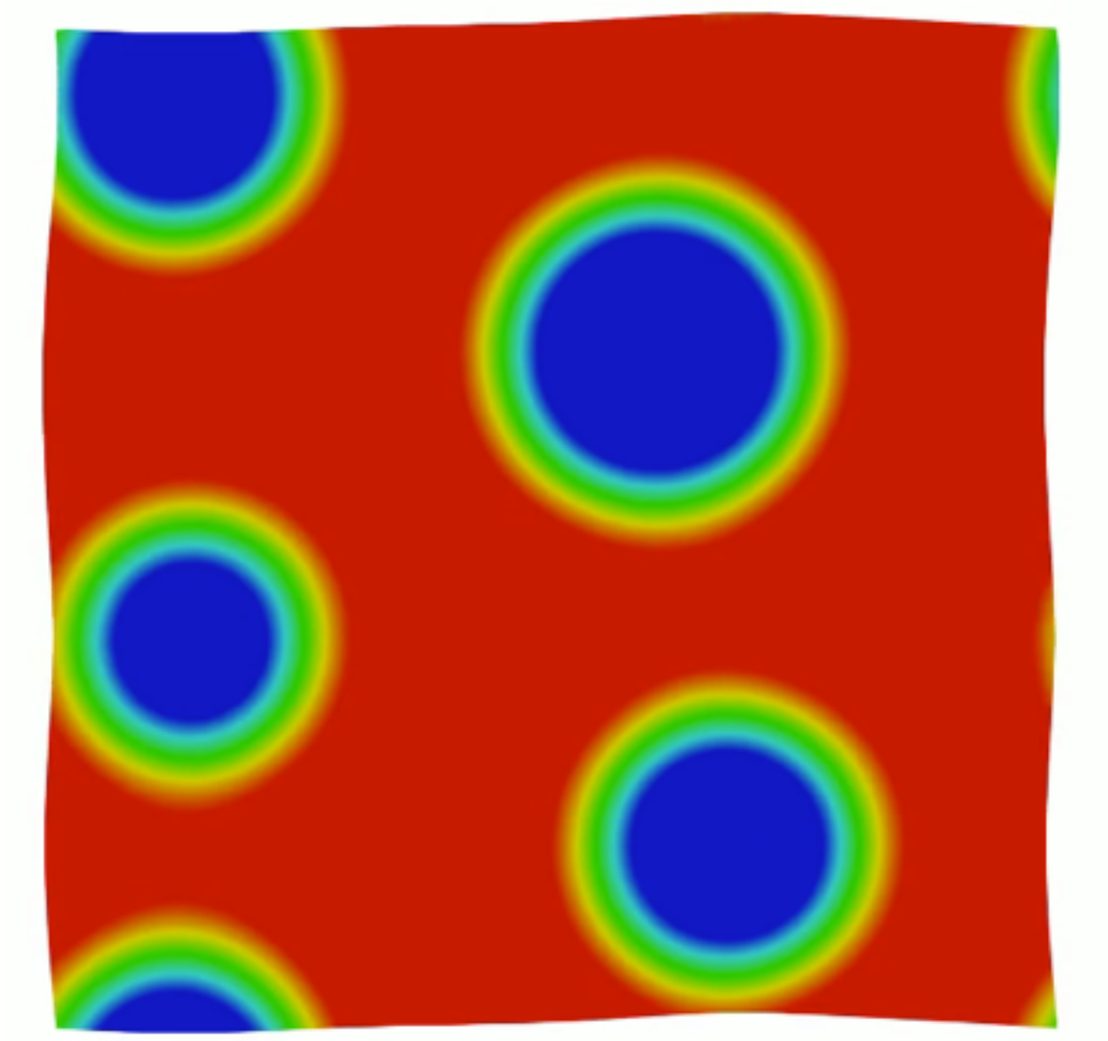
Course goals

- Learn the fundamentals of deal.II
  - Commonly used data structures, their interface
  - Structure of finite element problems
  - Good implementation practices
  - Navigate the documentation

Course goals

- Our goals (challenge) for you:
  Implement a solution to the uncoupled Cahn-Hilliard equation
  - Scalar problem
    - Nonlinear, time-dependent
    - Adaptive mesh refinement
    - Parallelised assembly and sparse linear solver
    - Verified assembly of linear system
    - Submit this as a tutorial to deal.II



Course schedule

Time	Duration	Content	Speaker	Content	Speaker
		MONDAY 19.03.2018		**TUESDAY 20.03.2018**	
09:30	1.25 hours	Introduction First steps	JPP	Local refinement Hanging nodes	JPP
		COFFEE / TEA			
11:15	1.25 hours	Introduction to FEM	LH	Local (adaptive) refinement Computing errors	LH
		LUNCH			
14:00	1.25 hours	Solving Poisson's equation	JPP	Shared memory parallelisation	JPP
		COFFEE / TEA			
15:45	1.25 hours	Exercises, Q&A	JPP, LH	Exercises, Q&A	JPP, LH
		WEDNESDAY 21.03.2018		**THURSDAY 22.03.2018**	
09:30	1.25 hours	MPI parallelisation: Part 1	JPP	Useful utility classes Git workflow	JPP
		COFFEE / TEA			
11:15	1.25 hours	Exercises, Q&A	JPP, LH	Time dependent problems Solution transfer	JPP
		LUNCH			
14:00	1.25 hours	MPI parallelisation: Part 2	LH	Automatic differentiation	JPP
		COFFEE / TEA			
15:45	1.25 hours	Exercises, Q&A	JPP, LH	Exercises, Q&A	JPP, LH

FRIDAY 23.03.2018

Project

How the course will be run

- Each module will have a lecture
    - Present salient information
    - Put what we'll learn into context
- Then we'll walk through aspects of the tutorials together
    - Discuss important functionality
        - What it does
        - How it works
        - Caveats and tips
- Remainder of the lecture will be spent doing some exercises
    - Suggestion: Work in groups of two/three
    - Continued at in the last session of the day

Resources

- deal.II user manual
  - https://www.dealii.org/developer/doxygen/deal.II/index.html
  - https://www.dealii.org/developer/doxygen/deal.II/modules.html
  - https://www.dealii.org/developer/doxygen/deal.II/DEALGlossary.html
- deal.II tutorials and code gallery
  - https://www.dealii.org/developer/doxygen/deal.II/Tutorial.html
  - https://www.dealii.org/developer/doxygen/deal.II/CodeGallery.html
- Us :-)
  - Don’t hesitate to ask questions