Technische Universität München
Institut für Informatik
Lehrstuhl für numerische Programmierung

Introduction to Scientific Computing

Collection of Exam Questions – Finite Differences and Finite Elements

Classification of questions:

- regular question – could well be part of the exam;
- ● more difficult question;
- ∗ probably too difficult or extensive for the exam (if too extensive, parts of the task might be appropriate, though);
- ❍ side topic – probably not part of the exam.

The list contains only questions that were generated by the students during the lectures. Consequently, there is no guarantee that the list is complete or representative. However, the questions cover an extensive part of the lecture, and I want to thank everyone who contributed to it.

1 Finite Differences

- Give a discretization of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$.
- What possibilities are the to improve the accuracy of Finite Difference Methods?
- Give the discretisation matrix A_h for a given problem. What are its properties?

2 Finite Elements

- What's a finite element?

- What are the main ingredients of FEM? Give a short description of the principle of FEM.
- Explain the workflow (individual tasks) during the finite element discretization up to the creation of the global stiffness matrix.
- What kind of basis functions are suitable (for a given problem)?
* Give a weak form for a given PDE (would be only asked for equations very similar to those discussed in the lecture).
* For what type of problems is FEM appropriate?

3 Others

- What are the main differences between the finite difference method and the finite element method?
- Where do you use which method?
- What are advantages of FED compared to FDM (and vice versa)?
- Explain the stencil notation.