MATH 6170
Differential Equations

The aim of the course is to develop a practical understanding of numerical methods for Partial Differential Equations (PDEs) by analyzing the methods and developing codes for different applications. PDEs appear and have applications in an enormous number of problems, including propagation of sound or heat, the motion of fluids, the description of electric and magnetic fields, as well as the behavior of biological systems like bacterial dynamics or tumor growth to name a few.

During the course we will discuss the following methods (and their applicability to different problems) as time permits:

- ⋆ Finite Difference Method
- ⋆ Finite Element Method
- ⋆ Finite Volume Method

References

[Allaire'07] Allaire, G.; *Numerical Analysis and Optimization: An introduction to mathematical modelling and numerical simulation.*
Oxford University Press (2007). ISBN 9780199205226

[Brenner-Scott'08] Brenner, S.C.; Scott, L.R.; *The Mathematical Theory of Finite Element Methods.*
Texts in Applied Mathematics, Springer-Verlag New York (2008). ISBN 978-0-387-75933-3

[Ciarlet'10] Ciarlet, L.C.; *The Finite Element Method for Elliptic Problems.*
Classics in Applied Mathematics, SIAM (2002). ISBN 978-0-89871-514-9

[Gatica'14] Gatica, G.N.; *A Simple Introduction to the Mixed Finite Element Method. Theory and Applications.*
Springer Briefs in Mathematics (2014). ISBN 978-3-319-03694-6

[LeVeque'07] LeVeque, R.J.; *Finite Difference Methods for Ordinary and Partial Differential Equations. Steady State and Time Dependent Problems.*
Society for Industrial and Applied Mathematics (SIAM), Philadelphia, (2007). ISBN 978-0-898716-29-0

[LeVeque'02] LeVeque, R.J.; *Finite Volume Methods for Hyperbolic Problems.*
Cambridge University Press, (2002). ISBN 0-521-81087-6

[Quarteroni'14] Quarteroni, A.; *Numerical Models for Differential Problems.*
Springer-Verlag Mailand (2014). ISBN 978-88-470-1070-3