UNIVERSITY OF BERGEN

Department of Mathematics

Responsible lecturer:
Kundan Kumar
Associate Professor, Department of Mathematics
Kundan.kumar@uib.no

Reading list for MAT 360:

MAT360 / Endeleg-element-metoden og områdedekomponering (Autumn 2017)

Finite Elements: Theory, Fast Solvers, and Applications in Elasticity Theory,
Author: Dietrich Braess,
Publisher: Cambridge University Press, ISBN 978-0-521-70518-9

The Mathematical Theory of Finite Element Methods
Authors: Brenner, Susanne, Scott, Ridgway
Publisher: Springer, ISBN 978-0-387-75933-3

Further details will be discussed later.

Mailing address: *Allegaten 41* *N-5007 Bergen, Norway*
Visiting address: *Allegaten 41*
Phone: *+47 97361093*
Telefax: *+47*

The course deals with the finite element method employed for solving a PDE. This will be an introductory course and will be aimed at the first time students taking such a course. Depending upon the background of the students, we will decide the balance between the theoretical vs practical issues.

The course will have mandatory assignments. The assignments will involve both programming Finite Element Code in Matlab as well as theoretical problems.

Tentative lecture plans:

1. Historical perspective; Introduction to a 1D problem; variational formulation, minimisation problem, classical solution
2. Finite element method for 1D problem; approximation; condition number of matrix; error estimates
3. Sobolev space in 1D, Poincare inequality, existence and uniqueness questions, properties such as maximum principle for 1D elliptic problem
4. Hilbert space theory, bilinearity, Lax Milgram lemma, extension of Sobolev spaces, trace inequalities, Poincare inequality in multi dimensions
5. Multidimensional elliptic problem; weak formulation, boundary conditions, existence, uniqueness
6. Finite element method in two and three dimensions
7. Practical implementation of FEM in 2D
8. Interpolation, inverse inequalities, Bramble-Hilbert lemma
9. Elliptic regularity, smoothness of domain boundaries
10. Mixed Finite Element Method