Linear and non-linear parabolic equations: weak formulations, approximations and analysis (2018)
Florin A. Radu

Lecture Structure
1 Preliminaries (Chapter 5 in [10]).
   – Sobolev spaces.
   – Inequalities.
   – Bochner spaces.
   – Compactness arguments. Papers: [31].

2 Linear parabolic equations (Chapter 7 in [10] and Chapter 6 in [10]).
   – Weak formulation (continuous variational formulation), regularity of solution.
   – Semigroup theory.
   – Rothe method, backward-Euler - Galerkin FE approximations/MFEM.
   – Stability and error estimates (Galerkin FE and MFEM).

3 Non-linear parabolic equations (different sources)
   – Weak solutions, regularity.
   – Fixed point theorems (Chapter 9 in [10]).
   – Stability and error estimates (Galerkin FE and MFEM). Papers: [3, 2, 28, 5].
   – Linearization methods.

4 Degenerate parabolic equations (different sources).
   – Weak formulation (continuous variational formulation), regularity of solution. Papers: [1, 27].
   – Numerical approximations (Galerkin FE and MFEM).
   – Stability and error estimates, Kirchhoff’s transformation and Green’s operator. Papers: [18, 19, 23, 27, 21].
   – Linearization methods. Papers: [20, 15, 24]
   – Domain decomposition methods. Papers: [29, 30]
Coupled elliptic and parabolic equations (different sources).

- Reactive transport in porous media [13, 14, 17, 22, 26, 25].
- Poromechanics (Biot’s model). Papers: [11, 16, 8, 4, 6, 7].

References


