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Seminar

Theorie und Numerik für Strömungen

SS 2023 — List of Topics

Session 1 - Mathematical preliminaries.

Session 2 - Well-posedness for Stokes. The main reference is [1]

- Characterisation of operators with closed range - Lemma C.37, Corollary C.38;

- Characterisation of bijective operators - Theorem C.49, Corollary C.50, (Lemma C.51);

- Banach-Nečas-Babuška Theorem - Theorem 25.9, Remark 25.13;

- Application to Stokes - Lemma 53.12.

Session 3 - Numerical analysis for Stokes. The discrete setting is described in Section 53.3/Proposition 53.14 in [1].

- Existence of a Fortin operator implies the inf-sup condition - Theorem 5.1 from [2];

- General strategy for constructing a Fortin operator - Lemma 54.2;

- Examples of non-inf-sup stable finite elements - Sections 53.4.2 and 53.4.3;

- The MINI element is inf-sup stable - Lemma 54.5.

Session 4 - Error estimates and beyond.

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Literatur

[1] A. Ern and J-L. Guermond. *Finite Elements II: Galerkin approximation, elliptic and mixed PDEs*, volume 73. Springer Nature, 2021.

[2] E. Süli. *A brief excursion into the mathematical theory of mixed finite element methods.* Lecture Notes: `https://people.maths.ox.ac.uk/suli/mixed_FEM_lectures.pdf`