

Condition

4h lecture, TU Berlin, SS 2019, Prof. P. Bürgisser

The lecture is based on Bürgisser and Cucker's monograph, *Condition: The Geometry of Numerical Algorithms*, Springer Grundlehren 349, 2013, to which we refer below in detail.

Chap. 1. Solving linear equations

- 1.1 Condition of a map [beginning of §14.1]
- 1.2 Vector and matrix norms [§1.1]
- 1.3 Turing's condition number [§1.2]
- 1.4 Condition and distance to ill-posedness [§1.3]

Chap. 2. A probabilistic analysis

- 2.1 Caps and tubes in spheres [Cor. 2.3 in §2.2.1, §2.2.6]
- 2.2 Probabilistic analysis of $\kappa_{rs}(A)$
 - 2.2.1 Preconditioning [§2.4.1]
 - 2.2.2 Average Analysis [§2.4.2]
 - 2.2.3 Uniform smoothed analysis [§2.4.3]
- 2.3 Probabilistic analysis for other norms [§2.5.1]
- 2.4 Probabilistic analysis for Gaussian distributions [§2.5.2]

Chap. 3. A geometric framework for condition numbers

- 3.1 Condition numbers revisited
 - 3.1.1 Complex zeros of univariate polynomials [§14.1.1]
 - 3.1.2 A geometric framework [§14.1.2]
 - 3.1.3 Linear equations solving [§14.1.3]
- 3.2 Complex projective space
 - 3.2.1 Projective space as a complex manifold [§14.2.1]

3.2.2 Distances in projective space [§14.2.2]

3.3 Condition measures on manifolds

3.3.1 Eigenvalues and eigenvectors [§14.3.1]

3.3.2 Computation of the kernel [§14.3.2]

Chap. 4. Homotopy Continuation and Newton's method

5.1 Homotopy methods [§15.1]

5.2 Newton's method [§15.2]

Chap. 5. Homogeneous polynomials systems [§16]

Chap. 6. Smale's 17th Problem [§17]