

# Extrapolation methods and their applications

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**Timetable:** 16 hours. Class meets on Tuesday from 14:00 to 16:00 and Thursday from 10:30 to 12:30. The first lecture will be on Tuesday, May 3, 2011, Torre Archimede. The room is 2BC/30, except for May 10 where the room will be the Room 2AB/45.

**Course requirements:** No special requirement is needed for this course. Only some fundamental knowledge of numerical analysis, but it could be acquired simultaneously with the lectures.

**Examination and grading:** Grading is based on homeworks or a written examination or both.

**SSD:** MAT/08 Numerical Analysis

**Aim:** These lectures are intended to students and researchers in pure and applied mathematics, in numerical analysis, and in scientific computing.

## Course contents:

1. Sequence transformations and convergence acceleration  
*When a sequence is slowly converging, one can transform it, without modifying its terms, into a new sequence which, under some assumptions, converges faster to the same limit. The theory of such sequence transformations will be studied.*
2. What is an extrapolation method?  
*Sequence transformation are showed to be, in fact, based on the idea of extrapolation which will be explained.*
3. Various extrapolation methods  
*We will describe various sequence transformations and the recursive algorithms which are used for implementing them.*
4. Vector sequence transformations  
*There exist special sequence transformations for accelerating the convergence of sequences of vectors. They will be reviewed.*
5. Applications  
*Sequence transformations and extrapolation algorithms have many applications outside the domain of convergence acceleration. We will consider the following ones*
  - (a) Treatment of the Gibbs phenomenon
  - (b) Web search
  - (c) Estimation of the error for linear systems
  - (d) Estimation of the trace of the inverse of a matrix
  - (e) Regularization of linear systems

## References

- [1] C. Brezinski, M. Redivo-Zaglia, *Extrapolation Methods. Theory and Practice*, North-Holland, Amsterdam, 1991.
- [2] J.P. Delahaye, *Sequence Transformations*, Springer-Verlag, Berlin, 1988.
- [3] A. Sidi, *Practical Extrapolation Methods. Theory and Applications*, Cambridge University Press, Cambridge, 2003.
- [4] E.J. Weniger, Nonlinear sequence transformations for the acceleration of convergence and the summation of divergent series, *Computer Physics Reports*, 10 (1989) 189-371.
- [5] J. Wimp, *Sequence Transformations and their Applications*, Academic Press, New York, 1981.