Numerical cubature and its applications

Alvise Sommariva[1]

[1] *Dipartimento di Matematica "Tullio Levi-Civita", Universitá di Padova*
Email: alvise@math.unipd.it

Timetable: 16 hrs. First lecture on November 11, 2024, 14:30 (dates already fixed, see on https://dottorato.math.unipd.it/calendar), Torre Archimede, Room 2BC30

Credits: 3

Course requirements: Basic knowledge of analysis, linear algebra and numerical analysis.

Examination and grading: Oral examination.

SSD: MAT/08

Aim: The aim of this course is to provide an overview of numerical cubature over multivariate domains, even with complex geometries. Next we show its application to the approximation of continuous functions and to the solution of integral equations.

Course contents:

- Quadrature rules: from Newton-Cotes formula to Gaussian rules
- Cubature rules on multivariate domains
- Quasi-Montecarlo methods
- Cubature rules compression by Tchakaloff theorem (time permitting)
- Hyperinterpolation on general domain (time permitting)
- Numerical solution of Fredholm integral equations of second kind on multivariate domains (time permitting)

Bibliography:

1. K. Atkinson, Numerical integration on the sphere, J. Austral. Math. Soc. Ser. B 23 (1981/82), pp. 332–347.
2. K. Atkinson, The Numerical Solution of Integral Equations of the Second Kind, Cambridge University Press; 1997.
3. J. Dick, F. Kuo, I.H. Sloan, High-dimensional integration: The quasi-Monte Carlo way, Acta Numerica, Cambridge University Press, 2013.
4. C.L. Lawson, R.J. Hanson, Solving Least Squares Problems, Classics in Applied Mathematics 15, SIAM, Philadelphia, 1995.
5. I.H. Sloan, Interpolation and hyperinterpolation over general regions, J. Approx. Theory 83 (1995), pp. 238–254.
6. A. Sommariva, Some cubature rules in Matlab, https://www.math.unipd.it/˜alvise/sets.html.
7. A. Sommariva and M. Vianello, Compression of multivariate discrete measures and applications, Numer. Funct. Anal. Optim. 20 (2015), pp. 1198–1223.