

**Course Title.** *Splines: basics and CAGD applications*

**Teacher(s).** Milvia Rossini

**Overview.** Splines are a well-established tool in many fields of approximation theory, going from data interpolation and data fitting to design and manipulation of freeform curves and surfaces. Computer Aided Geometric Design (CAGD) is the area of mathematics dedicated to the study of models used for computer description of object shapes. The course aims to be an introduction to spline theory and CAGD tools that may be of interest also for isogeometric analysis (IGA).

**When.** The course will take 28 hours and will run from half November to December 2020.

**Where.** University of Milano Bicocca or online depending on the prevailing Coronavirus emergency situation.

**Contacts.**

milvia.rossini@unimib.it

**Abstract.**

- Bernstein polynomials, Bézier curves, de Casteljau algorithm.
- Piecewise spaces: spline spaces, the one-sided basis and the B-spline basis.
- Spline interpolation.
- B-spline curves. Properties and fundamental geometric algorithms: knot insertion, subdivision, Oslo algorithm.
- Non Uniform Rational Splines (NURBS), representation of conic sections, weights' role.
- Multivariate splines: Tensor-product B-splines and NURBS

If time allows it, I will also like to cover the following topic:

- Beyond uniform meshes and tensor products: scattered data approximation.

**References.**

- W. Böhm, G. Farin, J. Kahmann, A survey of curve and surface methods in CAGD. *Comput. Aided Geom. Des.* 1, 160 (1984).
- C. de Boor, *A Practical Guide to Splines*, revised edition (Springer, 2001).
- G. Farin, *Curves and Surfaces for CAGD: A Practical Guide* (Elsevier, 2001).
- L. Piegl, W. Tiller, *The NURBS Book*, 2nd ed. (Springer, 1997).
- L.L. Schumaker, *Spline Functions: Basic Theory*, 3rd ed. (Cambridge University Press, 2007).
- H. Wendland, *Scattered Data Approximation* (Cambridge University Press, 2005).