

## Geometric modeling

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**January 22<sup>nd</sup> and 29<sup>th</sup> and February 5<sup>th</sup> and 12<sup>th</sup> 2021 (4 sessions)**  
**10:00 - 12:00 (a total of 8 hours)**

Geometric modeling and computer-aided design (CAD) are fundamental disciplines to represent real-life objects in digital world. We will discuss mathematical tools for geometric modeling, particularly focusing on problems appearing in computer numerically controlled (CNC) machining. We introduce basics of projective and differential geometry, and discuss suitable parametric representations of curves and surfaces (Bézier, B-spline, NURBS).

### PROGRAMME:

1. Projective geometry (homogenous coordinates, projective extension of an affine space, linear collineation in 2D, double ratio, Plücker coordinates, Klein quadric)
2. Parametric curves and surfaces (Frenet frame, curvature, torsion, principal curvatures, first and second fundamental form, Meusnier's theorem)
3. Bézier and B-spline curves and surfaces (Bernstein basis, control points, geometric continuity)

### PREREQUISITES:

- Calculus
- Linear Algebra

### REFERENCES:

- Farin, G., Hoschek J., and Kim M.-S. Handbook of computer aided geometric design. Elsevier, 2002.
- Cohen, E., Riesenfeld R., and Elber G. Geometric Modeling with Splines, AK Peters, Ltd., 2001.
- Pottmann, H. and Wallner, J., 2009. Computational line geometry. Springer Science & Business Media.

**\*Registration is free, but mandatory before Monday, 18<sup>th</sup> January 2021.** To sign-up go to <https://forms.gle/FBC6edL5eJYewTcM6> and fill the registration form.