Corso di Dottorato

"Pythagorean-hodograph curves: Theory and Application"

Professor Rida T. Farouki

Department of Mechanical and Aerospace Engineering
University of California Davis
E-mail: farouki@ucdavis.edu
Site: https://faculty.engineering.ucdavis.edu/farouki/

Abstract

Pythagorean Hodograph (PH) curves are special polynomial parametric curves, which are particularly useful in many applications ranging from Computer Numerical Control machining, Computer Aided Geometric Design to rigid body motion, as in formulating real-time interpolators to drive multi-axis CNC machines at constant or variable speeds along curved paths.
The course is designed to illustrate the basic theory of Pythagorean Hodograph (PH) curves, aiming to describe the main practical applications.

Reference: R.T. Farouki, Pythagorean-Hodograph Curves: Algebra and Geometry Inseparable, Springer, Berlin (2008)

Ore di Lezione: 20

Calendario Lezioni

Lecture I:	Venerdì 02/09, 11-13, aula Dal Passo
Lecture II:	Lunedi 05/09, 11-13, aula Dal Passo
Lecture III:	Lunedi 05/09, 14-16, aula Dal Passo
Lecture IV:	Mercoledì 07/09, 11-13, aula D'Antoni
Lecture V:	Mercoledì 07/09, 14-16, aula D'Antoni
Lecture VI:	Venerdì 09/09, 11-13, aula D'Antoni
Lecture VII:	Venerdì 09/09, 14-16, aula D'Antoni
Lecture VIII:	Lunedì 12/09, 11-13, aula Dal Passo
Lecture IX:	Lunedì 12/09, 14-16, aula Dal Passo
Lecture X:	Martedì 13/09, 11-13, aula Dal Passo

Programma del corso:

- **Lecture I -**
1. Introduction, outline, and materials for the short course.
2. Introductory concepts in algebraic & differential geometry.

- **Lecture II**
3. Introductory concepts in computer aided geometric design I.
4. Introductory concepts in computer aided geometric design II.

- **Lecture III**
5. The impossibility of rational arc length parameterizations.
6. Introduction to the planar Pythagorean–hodograph curves.

- **Lecture IV**
7. Advantageous properties of Pythagorean–hodograph curves
8. Complex representation of planar Pythagorean–hodograph curves

- **Lecture V**
9. Hermite interpolation by planar Pythagorean–hodograph curves
10. Planar Hermite interpolation subject to arc–length constraints

- **Lecture VI**
11. Spline interpolation by planar Pythagorean–hodograph curves
12. Brief introduction to (and history of) the quaternion algebra

- **Lecture VII**
13. Quaternion formulation of spatial Pythagorean–hodograph curves
14. Hermite interpolation by spatial Pythagorean–hodograph curves

- **Lecture VIII**
15. Rational orthonormal frames on Pythagorean–hodograph curves
16. Rotation–minimizing and minimal–twist frames on space curves

- **Lecture IX**
17. Design of rational rotation–minimizing rigid–body motions
18. Pythagorean–hodograph curves in path planning applications

- **Lecture X**
19. Pythagorean–hodograph curves in real–time motion control
20. Inverse dynamics compensation in computer numerical control

Per ulteriori dettagli contattare la Prof.ssa [Francesca Pelosi](#)