

Lecture Series by Prof. Dr. Kai Hormann:

Dr. Kai Hormann is a full professor in the Faculty of Informatics at Università della Svizzera italiana (USI), Lugano. He received a Ph.D. in computer science from the University of Erlangen-Nuremberg in 2002 and spent two years as a postdoctoral research fellow at Caltech in Pasadena and the CNR in Pisa, before joining Clausthal University of Technology as an assistant professor in 2004. During the winter term 2007/2008 he visited Freie Universität Berlin as a BMS substitute professor and came to Lugano as an associate professor in 2009. In 2018, he was a visiting professor at NTU Singapore.

His research interests are focused on the mathematical foundations of geometry processing algorithms as well as their applications in computer graphics and related fields. In particular, he is working on generalized barycentric coordinates, subdivision of curves and surfaces, barycentric rational interpolation, and dynamic geometry processing. Professor Hormann has published over 80 highly cited papers in the professional literature and is an associate editor of *Computer Aided Geometric Design*, *IEEE Transactions on Visualization and Computer Graphics*, *Computers & Graphics*, and the *Dolomites Research Notes on Approximation*. He served as chair of the SIAM Activity Group on Geometric Design in 2017/2018 and is entrusted with the chairmanship of the steering board of the international conference Geometric Modeling and Processing (GMP) since 2017.

Topic: Discussion Regarding the Research Projects
Day & Time: Monday, March 21, 2022 at 03:00 pm
Venue: Department of Mathematics, University of the Punjab, Lahore

Topic: Barycentric Rational Interpolation
Day & Time: Tuesday, March 22, 2022 at 10:30 am
Venue: Department of Mathematics, University of the Punjab, Lahore

Abstract: Interpolating given discrete data with continuous functions in one or more variables is a fundamental problem in diverse fields of science and engineering. In one variable, the idea of barycentric rational interpolation was pioneered by Berrut in 1988, who proposed a simple barycentric rational interpolant with guaranteed absence of real poles. In this talk, we will discuss how Berrut's approach can be generalized to obtain a novel family of barycentric rational interpolants. These interpolants are based on a particular blend of local polynomial interpolants of degree d with rational weight functions, and they are guaranteed to have no real poles. They reproduce polynomials up to degree d and can be evaluated efficiently and numerically stable, if expressed in barycentric form. They are particularly well-suited if the interpolation nodes are equidistant, a setting in which interpolation with polynomials can be very unstable and practically useless. We further show how to extend this idea to the Hermite setting, where derivative values given at the interpolation nodes are interpolated in addition to the function values.

Topic: Research Panel Discussion
Day & Time: Thursday, March 24, 2022 at 04:00 pm
Venue: Department of Mathematics, University of the Punjab, Lahore

Topic: **Quartic Bézier Curves with Rational Offsets**
Day & Time: Friday, March 25, 2022 at 10:30 am
Venue: Department of Mathematics, University of the Punjab, Lahore

Abstract: This talk is about planar properly-parameterized, regular quartic Bézier curves that have rational offsets. Such curves are either Pythagorean hodograph (PH) or indirect Pythagorean hodograph (iPH) curves, and they include all quadratic curves, cubic PH curves, and cubic iPH curves as special cases. We give a complete analysis of these curves and derive their algebraic and geometric characterizations. The characterizations are given in terms of quantities related to the Bézier control polygon of the curves. Based on the derived characterizations, several geometric construction algorithms using quartic curves with rational offsets are presented as applications, in particular C1 Hermite interpolation.

Topic: **Research Panel Discussion**
Day & Time: Saturday, March 26, 2022 at 10:30 am
Venue: Department of Mathematics, University of the Punjab, Lahore