Smooth splines on surfaces with arbitrary topology

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We consider the space of piecewise polynomial functions which are globally differentiable on a mesh of general topology. This space is characterized by gluing data across the shared edges [2]. Using algebraic techniques, which involve the analysis of the module of syzygies of the gluing data, we give a dimension formula for the space of geometrically smooth spline functions of degree less than or equal to a given constant, defined on surfaces of arbitrary topology. The dimension formula applies to spline spaces where the polynomial degree is sufficiently large. In the talk we will discuss this condition on the polynomial degree, and provide explicit constructions of basis functions attached respectively to vertices, edges and faces. These results can be extended to the study of the space of differentiable functions on a quad-mesh, which are composed of 4-split spline macro-patch elements on each quadrangular face [1]. We will present applications to fitting and reconstruction problems to illustrate the approach.

Joint work with: Ahmed Blidia, and Bernard Mourrain.

References

[1] A. Blidia, B. Mourrain and N. Villamizar. G^1-smooth splines on quad meshes with 4-split macro-patch elements. *Computer Aided Geometric Design*, 52: 106-125, 2017.

[2] B. Mourrain, R. Vidunas and N. Villamizar. Dimension and bases for geometrically continuous splines on surfaces of arbitrary topology. *Computer Aided Geometric Design*, 45: 108-133, 2016. 1781.