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Algebraic Spline Geometry

Abstract

We shall consider spline (or piecewise polynomial) functions defined on a partition of a real domain. Besides the practical applications of splines, including the solution of partial differential equations by the finite element method, and the approximation of shapes in geometric modeling, the space of continuous splines forms a ring, and one can study its algebraic structure. More precisely, the space of continuous splines on a simplicity complex is a quotient of the Stanley-Reisner ring of the corresponding complex, and the geometric realization of the Stanley-Reisner ring reflects the structure of the simplicial complex. In the talk, we shall consider some of the algebraic tools to approach the study of splines, both for the construction of vector spaces of splines that can be used for practical applications, as well as to explore their ring structure. The connection between the problems that appear in the construction of suitable spline spaces and (still open) problems in algebraic geometry such as the Hilbert function of ideals of fat points will also be presented.