Algebraic tools for the study of spline spaces

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A spline space attached to a partitioned domain is the vector space of functions which are polynomials (up to certain degree) on each piece of the partition and have a fixed order of global smoothness. In this talk, we will address the problem of finding the dimension of the spline space associated to a triangulation or a tetrahedral partition of a region in the plane or in the three dimensional space, respectively. Applying homological techniques and exploring connections of splines with ideals generated by powers of linear forms, we establish formulas for lower and upper bounds on the dimension of the spline space for any given degree and order of smoothness. The homological construction gives an insight into ways of computing the exact dimension for a given partition, and brings to light connections between the theory of splines and classical problems in algebraic geometry.