Some Applications of Algebraic Methods in Combinatorial Geometry Abstract:

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Abstract

An important class of problems in combinatorial geometry deals with incidences between points and lines (or other objects such as circles, planes, etc). In recent years, algebraic methods have been used to make significant progress on various incidence type problems. In this dissertation, we present some applications of these algebraic methods that generalize and improve upon older results. In the first result, we study the number of incidences between sets of points and spheres or planes in 3 dimensional Euclidean space. We introduce a natural notion of non-degeneracy and bound the maximum number of incidences between points and spheres or planes under this notion. These results are then used to study distance problems in Euclidean space. In another result, we study the lines determined by a finite point sets in complex space, and give bounds for the number of ordinary lines (lines containing exactly 2 points).

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