“Modern Computation for Schubert Calculus”

Abstract:

Hilbert’s fifteenth problem asks that Schubert’s enumerative calculus be put on a rigorous foundation. This was largely solved by Kleiman in the 1970’s, and it implied combinatorial rules to determine how many k-dimensional subspaces (k-planes) intersect general fixed subspaces with intersections having prescribed dimensions. When the fixed subspaces and prescribed dimensions admit finitely many k-planes, finding the k-planes is a "Schubert problem".

This Schubert calculus is connected to algebraic geometry and representation theory, and when the fixed subspaces osculate a rational normal curve, it has connections to inverse problems and the pole placement problem. Applications beyond mathematics include interference alignment for MIMO (cellular) networks.

We will discuss conjectures and theorems of osculating Schubert calculus with a theme of counting real solutions to systems arising from geometry. We will see general polynomial systems for which the number of real solutions is an invariant. This is unexpected as a system of one polynomial in one variable does not have such an invariant. We will also describe the intertwining of this theory with systematic computational investigation. This interplay inspired advances in formulating Schubert problems to allow more efficient use of numerical methods to solve the relevant systems, and this has made Schubert calculus more relevant to subjects beyond pure mathematics.

Friday, October 16, 2015
3:00 PM in 372 Jabara Hall

Please come join us for refreshments before the lecture at 2:30 p.m. in room 353 Jabara Hall.