INTRODUCTION TO APPLICABLE ALGEBRAIC GEOMETRY

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1. The Course

Algebraic Geometry, the geometric study of polynomial equations, has a long history as a core discipline within pure mathematics. In recent years it has been finding many new applcations outside of mathematics. For example, the IMA[1] is devoting the current academic year to a program on applications of algebraic geometry, and Texas A&M will be hosting a summer school during July and August on "Applicable Algebraic Geometry"[2], with 30-50 students attending from across the United States. Several TAMU faculty work in this growing area.

The purpose of this Spring 2007 course will be to give students an introduction to the applicable side of algebraic geometry. We will see the basic concepts of commutative algebra and algebraic geometry that will be assumed prerequisites for the summer school. This course may also be used as preparation for the more comprehensive algebraic geometry course that may be offered next year. Along the way, we will show how some tools from commutative algebra and algebraic geometry can be used to solve systems of polynomial equations, you will see many fundamental classes of varieties that arise in algebraic geometry, and you will be exposed to some of these new applications of algebraic geometry.

Prerequisites: Linear algebra and abstract algebra. (See instructors if you have questions.)

2. Topics

(1) Polynomials, ideals, varieties
- Algebra-geometry dictionary
- Varieties
- Gröbner bases

(2) Systems of polynomial equations
- Elimination and resultants
- Gröbner basis conversion
- Finding real roots
- Enumeration and bounds on number of solutions

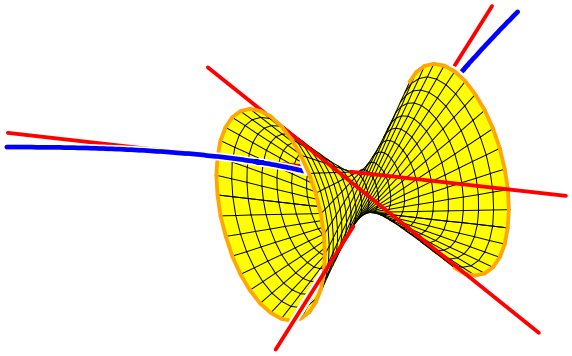
(3) Ideals and Varieties
- Monomial ideals
- Toric varieties and polytopes
- Determinantal Ideals

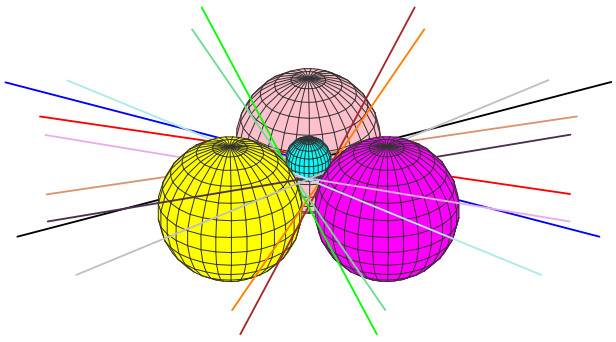
(4) Applications
- Optimization
- Integer programming
- Statistical inference
- Geometric Modelling

3. Textbooks

- Cox, Little, O'Shea, "Ideals, varieties, and algorithms", Springer UTM, 1997. $60.-
- Sturmfels, "Solving systems of polynomial equations", AMS, 2002. $34.-

(Amazon Price)





[1]Institute of Mathematics and its Applications
[2]http://www.ima.umn.edu/2006-2007/PISG7.23-8.10.07/