Real Algebraic Geometry for Applications.

Real algebraic geometry is a fundamental input for many applications of algebraic geometry. Its goals and methods are also distinct from classical algebraic geometry. I expect to cover topics such as real solutions to systems of equations, including upper and lower bounds, positivity and sums of squares, real toric varieties, and non-standard real structures.

This is based on parts of my book "Real solutions to Equations from Geometry", two chapters in Theobald's book "Real Algebraic Geometry and Optimization", as well as papers and other sources.

Grading is through class attendance and end-of-term presentations.

NOTE: To sign up for this and for Landsberg's Algebraic Geometry II (both MATH 666), you need to write Briana Hague and ask for a waiver.

Course WWW: https://franksottile.github.io/teaching/25.1/RAGA.html

Course Outline:

Classical methods for real roots of equations
- Theorems of Sturm and Descartes
- Stability and Routh-Hurwicz
- Hermite trace form

Positive polynomials
- Positivity and sums of squares
- Hilbert's 17th problem
- Positivstellensatz
- Theorems of Polya, Handelman, Putinar, and Schmudgen

Bounds on numbers of real solutions
- Gale duality for upper bounds
- Lower bounds
- Conditions for injectivity

Real toric varieties
- Real points of toric varieties
- Non-standard real toric varieties
- Irrational toric varieties