USNA Math Department Colloquium

Non-commutative Gröbner bases and twisty puzzles

Prof. Martin Kreuzer (Universität Passau)

Date: Wednesday, 4 December 2013

Time: 3:45-4:45pm*

Location: Chauvenet 110

Abstract: Given an alphabet $X = \{x_1, ..., x_n\}$, the free associative algebra $K\langle X\rangle$ over a field K is also called the non-commutative polynomial ring over K. To enable explicit computations with non-commutative polynomials, the theory of Gröbner bases is generalized from the commutative case to $K\langle X\rangle$. After introducing the basic elements of this theory, we show how to determine non-commutative Gröbner bases using the Buchberger Procedure, and how to optimize this procedure. Then we discuss fundamental applications of these algorithms. Finally, we relate non-commutative Gröbner bases to the task of solving twisty puzzles. In particular, we explain that "God's Algorithm" for Rubik's cube can be interpreted as a Gröbner basis calculation.

*The talk will be preceded by tea and cookies starting at 3:30pm.