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Elementary recursive degree bounds for Positivstellensatz and Hilbert's 17th problem

Abstract: Hilbert's 17th problem is to express a non-negative polynomial as a sum of squares of rational functions. The original proof by Artin is non-constructive and gives no information on degree bounds. A more general problem is to give an identity which certifies the unrealizability of a system of polynomial equations and inequalities. The existence of such an identity is guaranteed by the Positivstellensatz, and Hilbert 17th problem as well as Real Nullstellensatz follow easily from such identity. In this talk, we present a constructive proof which provides elementary recursive bounds for the Positivstellensatz, Hilbert's 17th problem, and the Real Nullstellensatz, namely a tower of five levels of exponentials. This is a joint work with Henri Lombardi (Universit de Franche-Comt, France) and Marie-Francoise Roy (Universit de Rennes 1, France).