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Stability of Hilbert points with respect to linearizations of small, fixed degree

Ian Morrison

Fordham University

GIT quotients of loci in Hilbert schemes are a basic tool for studying moduli spaces of curves. The Hilbert-Mumford weights in these problems are polynomials in a degree m corresponding to the GIT linearization. The classical approach of Gieseker computes the sign of the leading term of this polynomial and hence only shows semistability asymptotically, for large m. Recently applications have arisen in the log minimal model program (LMMP) that require handling fixed, usually small, values of m. I will review joint work with Dave Swinarski that provides a way to verify semistability for fixed m for special curves with large automorphism groups and a set of examples due to Alper, Fedorchuk and Smyth that cover the cases in the LMMP applications.
