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On the computation of nonconvex hulls

An open problem in the calculus of variations is the computation of the quasiconvex envelope of a given set of matrices. Also, main results in relaxation theory rely on the quasiconvex envelope of a function. Such a envelope or hull, however, is known only for very specific cases.

Therefore, we want to study two related, but simpler, notions of convexity, namely separate convexity and rank-1-convexity. We present a graph-theoretical method for the computation of the separate convex envelope of a finite set of matrices.

For rank-1-convexity, we want to answer the following question: Given a finite set of matrices, does it contain a Tartar square? Tartar squares are known to be a main obstruction for nontrivial rank-1-convex hulls, and indeed new results indicate that the algorithm presented in the talk indeed can show triviality of the rank-1-convex hull for a large class of configurations. Unlike previous approaches, we do not build on numerical methods (in the sense of discretization). Rather, we use methods of computational algebraic geometry to avoid mistakes due to rounding errors and get exact results in a few seconds.