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Polynomial recognition of cluster algebras of finite type

Cluster algebras form a class of commutative algebra, introduced at the beginning of the millennium by Fomin and Zelevinsky. They are defined constructively from a set of generating variables (cluster variables) grouped into overlapping subsets (clusters) of fixed cardinality. Since its inception, the theory of cluster algebras found applications in many areas of science, specially in mathematics. An important problem is to establish whether or not a given cluster algebra is of finite type. Using the standard definition, the problem is infeasible since it uses mutations that can lead to an infinite process. In 2006, Barot, Geiss and Zelevinsky presented an easier way to verify if a given algebra is of finite type, by testing if all chordless cycles of the graph related to the algebra are cyclically oriented and if there exists a positive quasi-Cartan companion of the skew-symmetrizable matrix related to the algebra. Based on this result, we develop an algorithm that verifies these conditions and decides whether or not a cluster algebra is of finite type in polynomial time. The second part of the algorithm is used to prove that the more general problem to decide if a matrix has a positive quasi-Cartan companion is in NP-class.