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Combinatorial aspects of double Bruhat cells and cluster algebras

Abstract: In this thesis, we compute orbits for the linear action of groups generated by transvections with respect to a certain class of bilinear forms on a finite dimensional vector space over the two-element field. In particular, we give an explicit description of orbits that are in bijection with connected components of an arbitrary real double Bruhat cell in a semisimple group, extending results of M.Gekhtman, B. Shapiro, M. Shapiro, A.Vainshtein and A. Zelevinsky. We also compute the list of all minimal 2-infinite diagrams, which are cluster algebraic analogues of extended Dynkin graphs.