

# Lawrence polytopes and some invariants of a graph

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We use two dual Lawrence polytopes  $P$  and  $P^*$  of a graph  $G$  to study the graph. The  $h$ -vector of the graphic (resp. cographic) matroid complex associated to  $G$  coincides with the  $h^*$ -vector of the Lawrence polytope  $P$  (resp.  $P^*$ ). In general, the  $h$ -vector is an invariant defined for an abstract simplicial complex, which encodes the number of faces of different dimensions. The  $h^*$ -vector, a.k.a. the  $\delta$ -polynomial, is an invariant defined for a rational polytope obtained by dilating the polytope. By dissecting the Lawrence polytopes, we may study the  $h$ -vectors associated to the graph  $G$  at a finer level. In particular, we understand the reduced divisors of the graph  $G$  in a more geometric way.

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