# The lattice size of lattice polygons with respect to the 2-simplex

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**Abstract**

The lattice size of a lattice polygon $P$, denoted $\mathrm{ls}(P)$, is the smallest number $n$ such that the image of $P$ under an affine unimodular transformation is contained within the $n$-dilate of the standard 2-simplex. An optimal transformation $T$, one such that $TP$ fits in the smallest possible dilate, can be used to find a "better" parametrization of a toric surface. Results from Castryck, Cools, and Shicho show that there is a recursive algorithm to find such a $T$ by relating $\mathrm{ls}(P)$ to the lattice size of the convex hull of the interior lattice points of $P$. We have developed an algorithm that needs only the vertices of $P$ and so avoids the computational expense of determining the interior lattice points. We show that if a fixed, finite set of transformations does not yield a "smaller" image of $P$, then $P$ can be translated to fit in the smallest possible dilate of the simplex.