

## Covering Orthogonal Polygons with Star Polygons: The Perfect Graph Approach

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### ABSTRACT

We consider the problem of covering simple orthogonal polygons with star polygons. A star polygon contains a point  $p$ , such that for every point  $q$  in the star polygon, there is an orthogonally convex polygon containing  $p$  and  $q$ .

In general, orthogonal polygons can have concavities (dents) with four possible orientations. In this case, we show that the polygon covering problem can be reduced to the problem of covering a weakly triangulated graph with a minimum number of cliques. Since weakly triangulated graphs are perfect, we obtain the following duality relationship: the minimum number of star polygons needed to cover an orthogonal polygon  $P$  without holes is equal to the maximum number of points of  $P$ , no two of which can be contained together in a covering star polygon. Further, the Ellipsoid method gives us a polynomial algorithm for this covering problem.

In the case where the polygon has at most three dent orientations, we show that the polygon covering problem can be reduced to the problem of covering a triangulated (chordal) graph with a minimum number of cliques. This gives us an  $O(n^3)$  algorithm.

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† Supported by the National Science Foundation under grant DCR-8411954.

‡ Supported by the Semiconductor Research Corporation under grant SRC-52055.