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Beacon Coverage in Orthogonal Polyhedra

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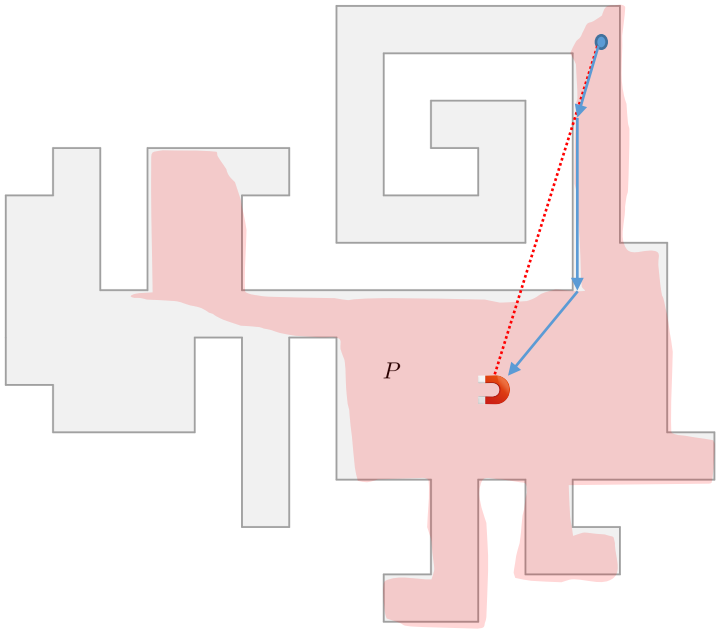
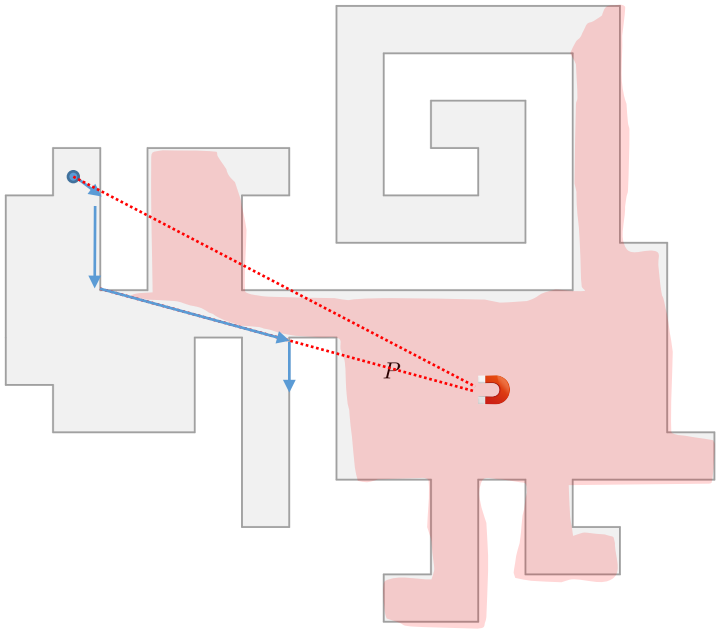
E. Solís-Villarreal* J. Urrutia‡ C. Velarde§

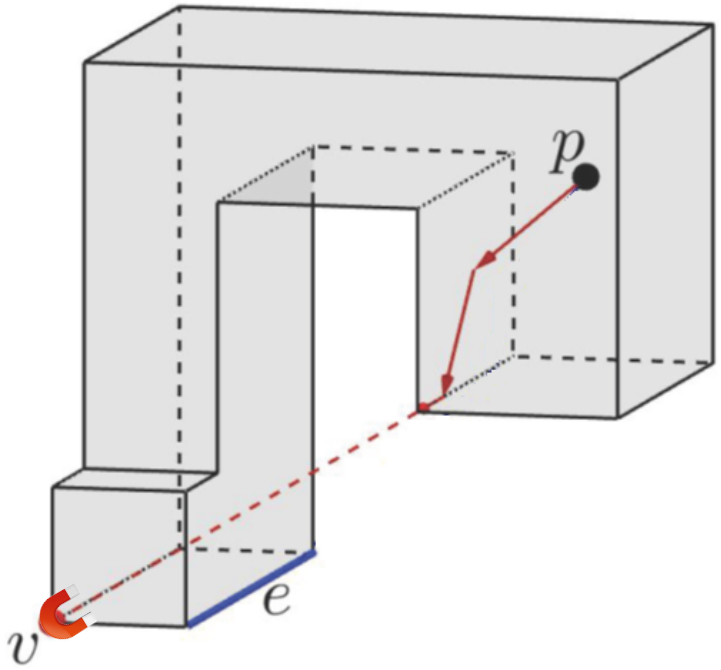
Beacon coverage



Beacon coverage



Vertex and edge beacon coverage in 3D

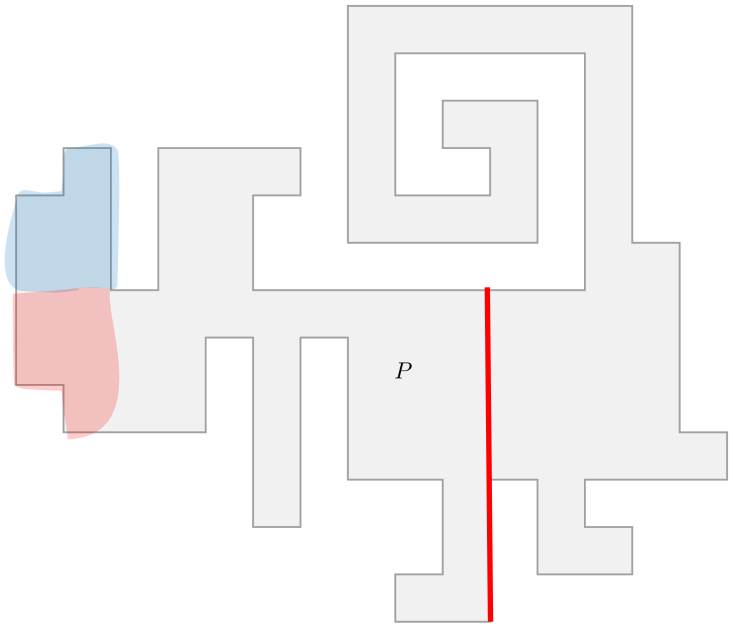


Beacon coverage problems in orthogonal polygons and orthogonal polyhedra

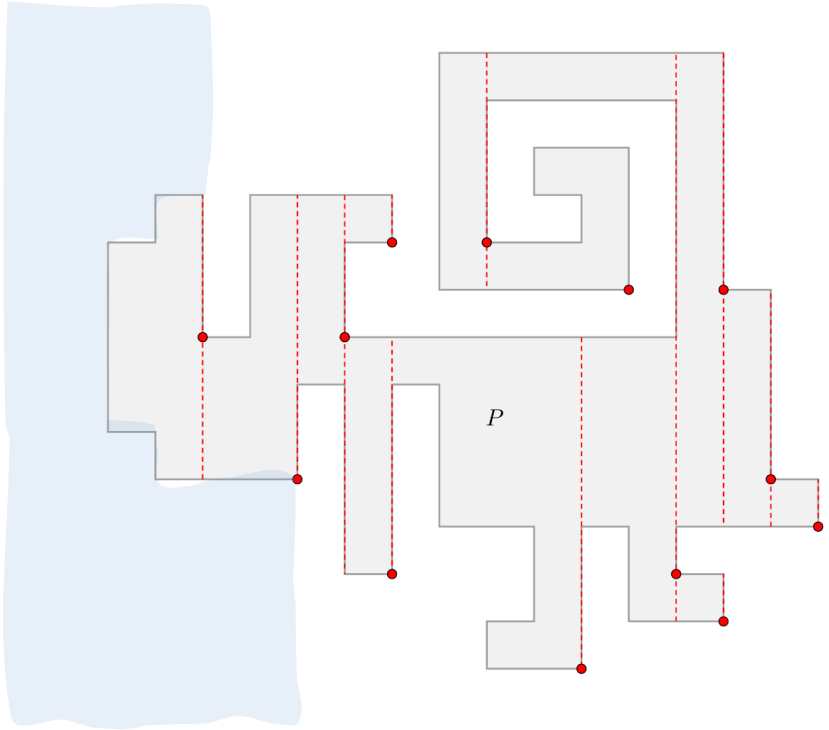
	Coverage	Lower bound	Upper bound
Polygons	*Interior*	n/6 [Bae et al. 2016]	n/6 [Bae et al. 2016]
	Interior-Exterior	?	n/4
Polyhedra*	*Interior*	e/21	e/12
	Interior-Exterior	?	e/6

** Vertex beacons are not sufficient to cover the interior of any general polyhedra* [Cleve J. 2017]

Covering the interior of orthogonal polygons

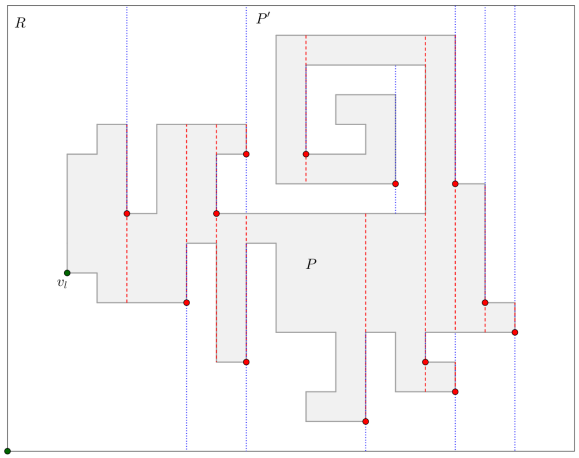


Covering the interior-exterior of orthogonal polygons

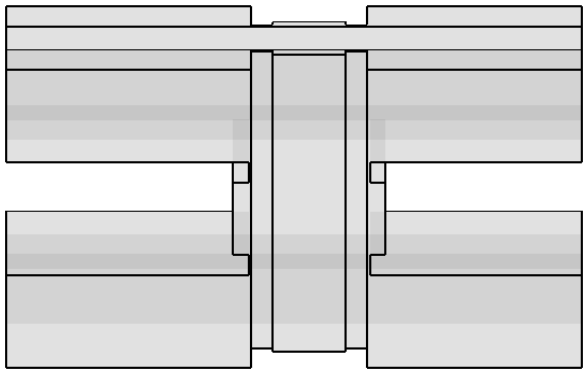


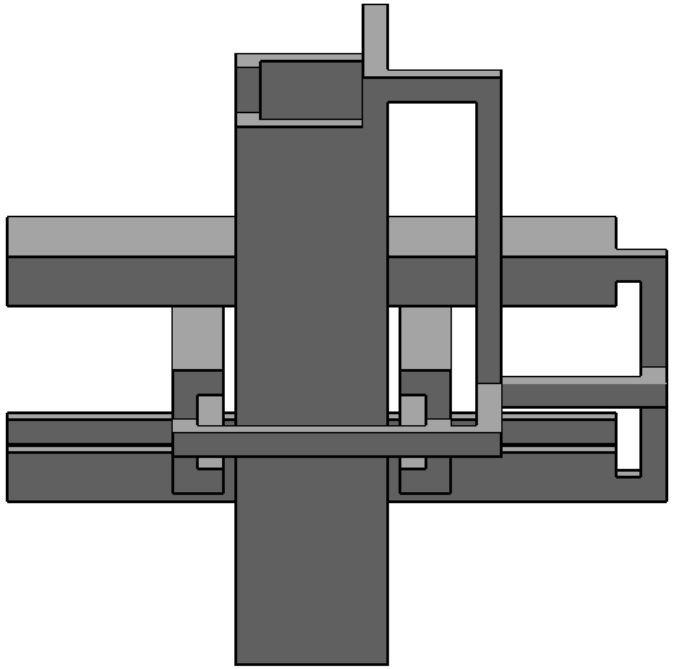
Covering the interior-exterior of orthogonal polygons

Theorem 1 *Let P be an orthogonal polygon (possibly with holes) with n vertices. Then $\lfloor \frac{n}{4} \rfloor + 1$ vertex beacons are always sufficient to simultaneously cover the interior and the exterior of P.*

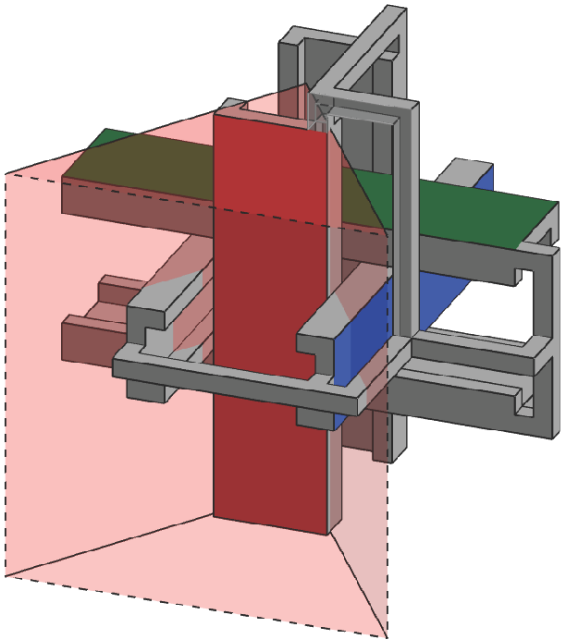


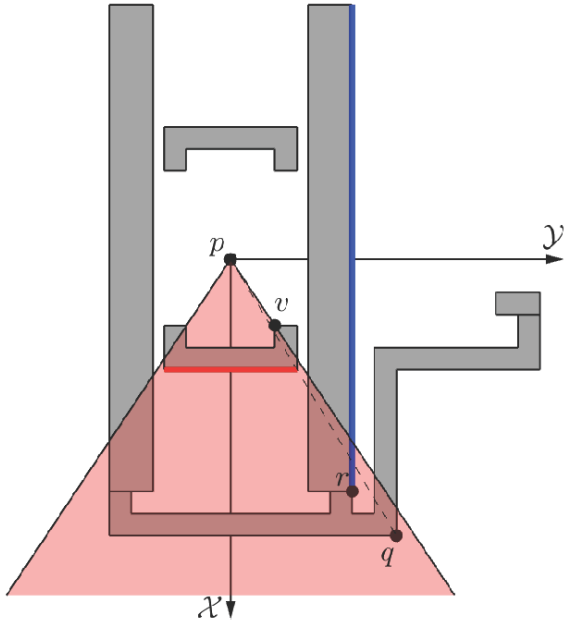
Counterexamples of non coverable orthogonal polyhedra.



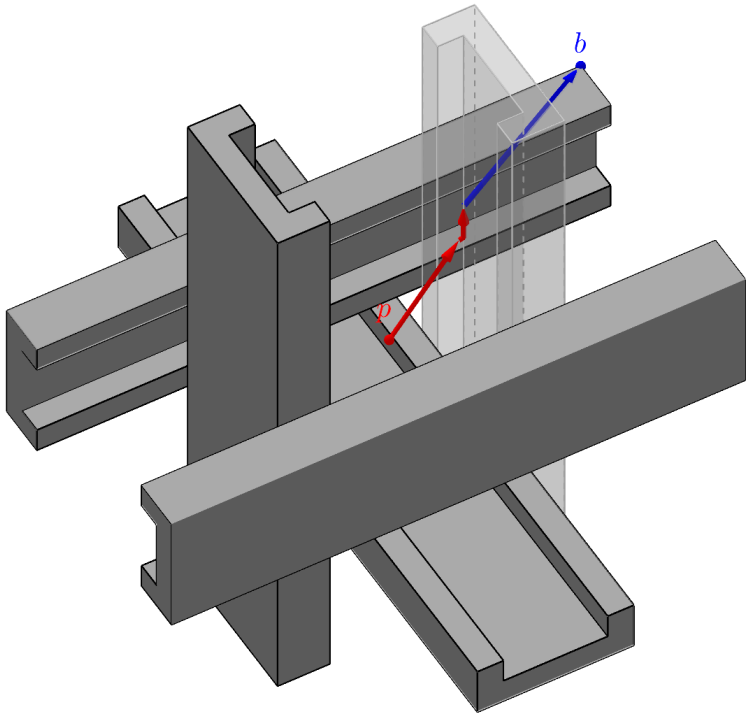


Counterexamples of non coverable orthogonal polyhedra.

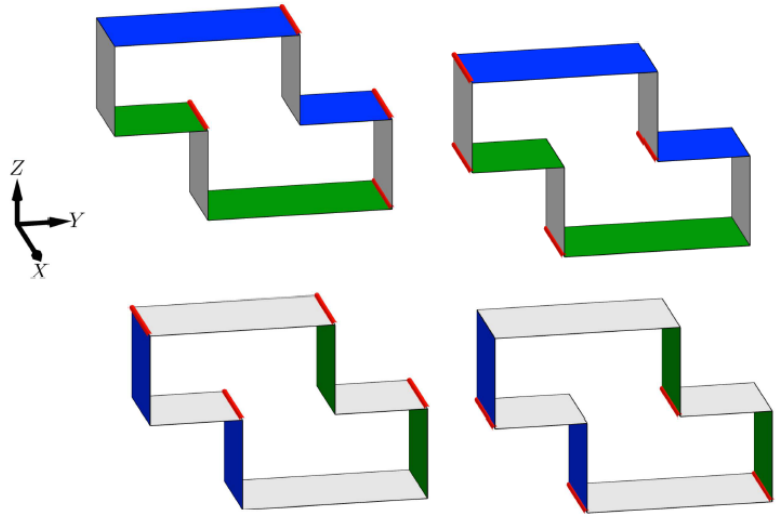




Counterexamples of non coverable orthogonal polyhedra.



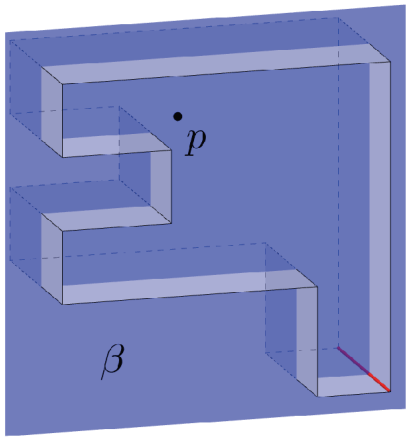
Covering the interior of orthogonal polyhedra

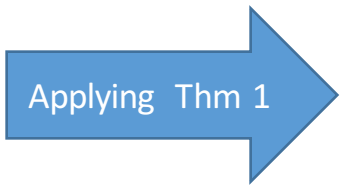


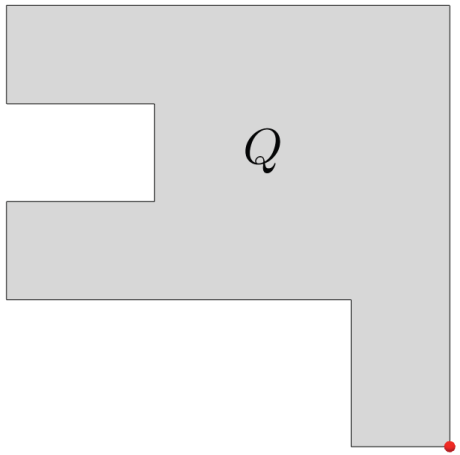
There exist an orientation with at most e/3 edges, and one class with at most e/12 edges.

Covering the interior of orthogonal polyhedra

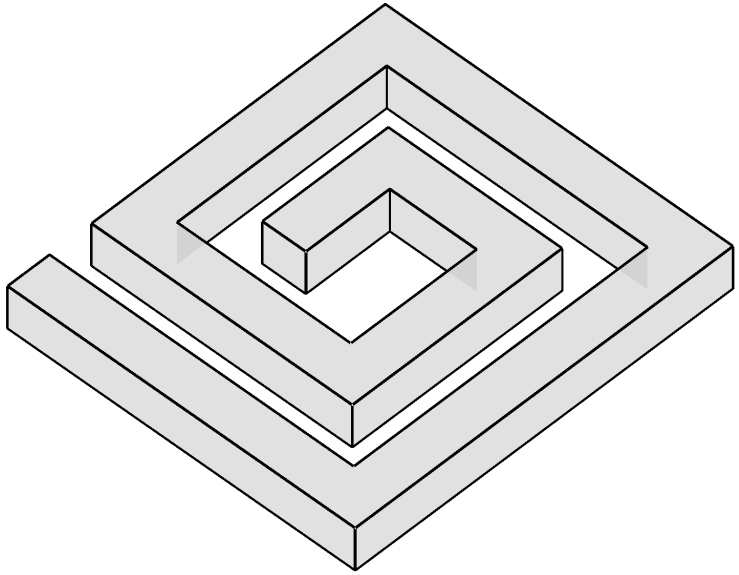
Theorem 3 *Let P be an orthogonal polyhedron with e edges. Then $\lfloor \frac{e}{12} \rfloor$ edge beacons are always sufficient to cover P.*



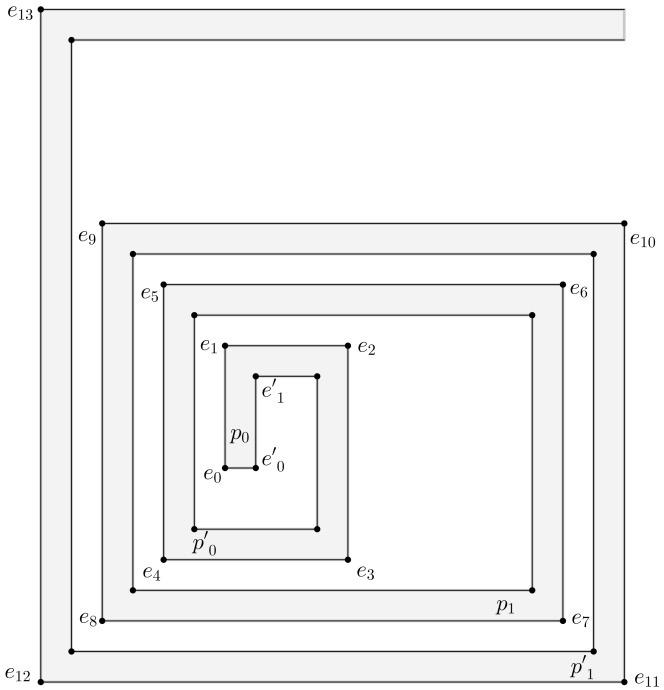




Lower bound on the number of beacons to cover the interior

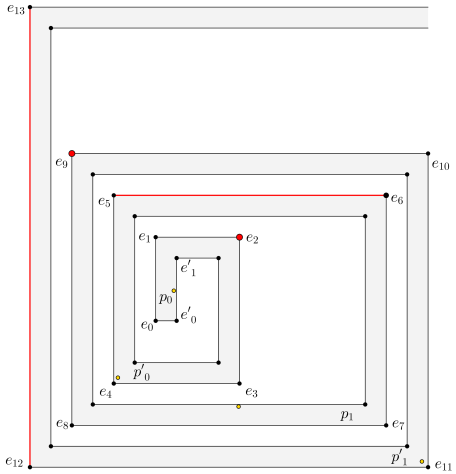


Lower bound on the number of beacons to cover the interior



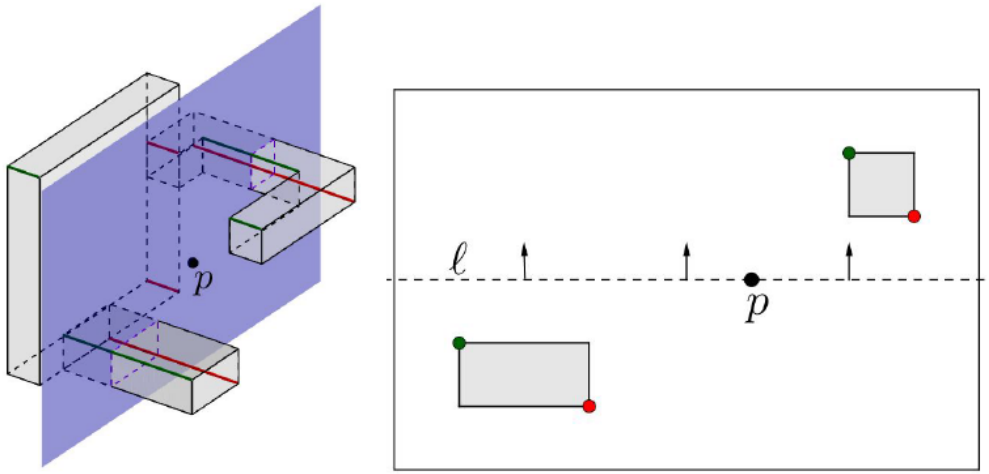
Lower bound on the number of beacons to cover the interior

Theorem 4 *There exists a family of orthogonal polyhedra with e edges, such that $\lfloor \frac{e}{21} \rfloor$ edge beacons are necessary to cover their interior.*



Covering the interior-exterior of orthogonal polyhedra

Theorem 5 *Let P be an orthogonal polyhedron with e edges. Then $\lfloor \frac{e}{6} \rfloor$ edge beacons are always sufficient to simultaneously cover the interior and exterior of P.*



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Thanks for your attention!

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