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Title: Constrained triangulations, volumes of polytopes, and unit equations

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Given a polytope $\mathcal{P}$ in $\mathbb{R}^d$ and a subset U of its vertices, is there a triangulation of $\mathcal{P}$ using d-simplices that all contain U? We answer this question by proving an equivalent and easy-to-check combinatorial criterion for the facets of $\mathcal{P}$. Our proof relates triangulations of $\mathcal{P}$ to triangulations of its "shadow", a projection to a lower-dimensional space determined by U. In particular, we obtain a formula relating the volume of $\mathcal{P}$ with the volume of its shadow. This leads to an exact formula for the volume of a polytope arising in the theory of unit equations.

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