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Resolutions of Nerves of Graphs

The nerve $\mathcal{N}(\Delta)$ of a simplicial complex Δ is a simplicial complex whose vertices correspond to facets of Δ and whose facets correspond to vertices of Δ . We examine $\mathcal{N}(G)$, considering the graph as a simplicial complex, and identify structures and properties of the original graph G recognizable in the resolutions of the Stanley-Reisner ideal of $\mathcal{N}(G)$. Specifically, via the (multi)graded betti numbers of $I(\mathcal{N}(G))$, we enumerate all spanning trees of G , all maximal matchings of G , and numerous other features of our graph. Additionally, we produce new classes of edge ideals $I_{G'}$ with bounded regularity and other highly proscribed invariants.