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Maximum Frustration in Signed Complete Bipartite Graphs

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The *frustration index* of a signed graph is the smallest number of edges whose sign reversal yields a balanced signed graph (i.e., where all circles have positive sign product). In 1966, Petersdorf showed that the maximum frustration of a signed complete graph K_n is equal to floor[$(n\text{-}1)^2/4$], and it is achieved by the all-negative signing. This is the only interesting graph family for which the problem has been solved. Using convex geometry, I show that the maximum frustration for a signed $K_{l,r}$ is bounded above by

$$r \cdot (l/2) \cdot [\ 1 - 2^{-(l-1)}\ \text{binom}(\ l-1,\ \text{floor}[(l-1)/2]\ )\ ]$$

and that this bound is achieved by a signing of $K_{l,2^{l-1}}$.
