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Equiangular lines and abelian covers of complete graphs

A set of lines in \mathbb{R}^n (or \mathbb{C}^n) is said to be equiangular if the inner product of every pair of them has the same absolute value. An equiangular set of lines in d real (complex) dimensions has size at most $\binom{d+1}{2}$ (d^2 in the complex case). Few results are known about the existence of a set of equiangular lines of maximum size.

A graph X is a cover of another graph Y if for each vertex of Y there is an independent set associated with it in X , and each edge in Y is represented by a perfect matching between the respective independent sets in X .

Each antipodal distance-regular cover of a complete graph is determined by three parameters. There are many conditions that these three parameters have to satisfy. We will see that we can find a set of equiangular lines for each abelian cover. This relation between equiangular lines and abelian covers leads to new feasibility conditions for the parameters of the cover. In particular the existence of an antipodal distance-regular cover with certain parameters guarantees the existence of a set of equiangular lines of maximum size.