

**The classification of  $2$ - $(v, k, \lambda)$  designs, with  $\lambda > 1$  and  $(r, \lambda) = 1$ , admitting a flag-transitive automorphism group.**

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A classical subject in Theory of Designs is the study of  $2$ -designs admitting an automorphism group fulfilling prescribed properties. Within this research area, it is of great interest the study of  $2$ - $(v, k, \lambda)$  designs  $\mathcal{D}$  admitting a flag-transitive automorphism group  $G$ . Since they have been classified for  $\lambda = 1$  and  $G \not\leq A\Gamma L_1(q)$  by Buekenhout et al. (1990), a special attention is devoted to the general case  $\lambda > 1$ . In this setting, a first natural generalization of the case  $\lambda = 1$  is represented by  $\lambda > 1$  and  $\gcd(r, \lambda) = 1$ , where  $r$  is the replication number of  $\mathcal{D}$ . Then  $G$  acts point-primitively on  $\mathcal{D}$  by a result of Dembowski (1968), and  $Soc(G)$ , the socle of  $G$ , is either an elementary abelian  $p$ -group for some prime  $p$ , or a non abelian simple group by a result of Zeischang (1988). Starting from these two results, such  $2$ -designs have been recently classified for  $G \not\leq A\Gamma L_1(q)$  by Biliotti et al. and by Alavi, Zhou et al. according to whether  $Soc(G)$  is an elementary abelian  $p$ -group or a non abelian simple group, respectively.

The aim of the talk is to survey the classification of  $2$ - $(v, k, \lambda)$  designs  $\mathcal{D}$ , with  $\lambda > 1$  and  $(r, \lambda) = 1$ , admitting a flag-transitive automorphism group  $G$ , mostly focusing on the constructions of the various examples contained in it.