

## On equitable partitions of divisible design graphs

Dmitry Panasenko

*Chelyabinsk State University, Chelyabinsk, Russia*

makare95(at)mail.ru

This is joint work with Sergey Goryainov and Leonid Shalaginov

An equitable  $t$ -partition of a graph  $\Gamma$  is a partition of the vertex set of  $\Gamma$  into  $t$  parts  $P_1, \dots, P_t$  such that, for all  $i, j \in \{1, \dots, t\}$ , every vertex of  $P_i$  is adjacent to the same number, namely,  $p_{ij}$ , of vertices of  $P_j$ . The matrix  $\Pi := (p_{ij})_{i,j=1,\dots,t}$  is called the quotient matrix of the equitable  $t$ -partition. It is well known that every eigenvalue of  $\Pi$  is an eigenvalue of the adjacency matrix of  $\Gamma$ .

A  $k$ -regular graph  $\Gamma$  with  $v$  vertices is called a *divisible design graph* with parameters  $(v, k, \lambda_1, \lambda_2, m, n)$  if the vertex set can be partitioned into  $m$  classes of size  $n$ , such that two distinct vertices from the same class have exactly  $\lambda_1$  common neighbors, and two vertices from different classes have exactly  $\lambda_2$  common neighbors (see [1]). By [1, Lemma 2.1], a divisible design graph has at most five eigenvalues, which can be expressed in terms of the parameters.

In this work we study and classify equitable 2-partitions for several families of divisible design graphs.

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## References

- [1] W. H. Haemers, H. Kharaghani, M. Meulenberg, Divisible design graphs. *J. Combinatorial Theory A* **118** (2011) 978–992.