

## On some cyclic and 1-rotational multigraph designs

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Let  ${}^\lambda K_v$  denote the complete  $\lambda$ -fold multigraph of order  $v$ . Let  $\lambda$  and  $n$  be positive integers such that  $\lambda$  divides  $2n$  let  $G$  with  $n$  edges be a subgraph of  ${}^\lambda K_{\frac{2n}{\lambda}}$ . We discuss some Rosa-type labelings of  $G$  that lead to either cyclic  $G$ -decompositions of  ${}^\lambda K_{\frac{2n}{\lambda}+1}$  or to 1-rotational  $G$ -decompositions of  ${}^\lambda K_{\frac{2nx}{\lambda}}$  for every positive integer  $x$ . We use these labelings to investigate  $G$ -decompositions where  $G$  is an even cycle with alternating double-edges.

Keywords: multigraph design, cyclic  $G$ -decomposition, 1-rotational  $G$ -decomposition, multigraph labeling