



## ON A RELATION BETWEEN $G$ -GRAPHS AND LIFTS

ŠTEFAN GYÜRKI\*, PAVOL JÁNOŠ, JOZEF ŠIRÁŇ

Constructions of regular graphs based on groups are quite popular, since some of the graph invariants can be computed algebraically simply from the knowledge of the used group and its basic properties. The most famous such construction of graphs from groups are known as Cayley graphs. A similar construction of graphs having highly regular properties is called  $G$ -graphs. Another one is called the technique of voltage assignments, or lifts, which can be regarded, in a sense, as a generalization of the concept of Cayley graphs. An advantage of the lifting construction and  $G$ -graphs in comparison with the Cayley graphs might be that they can also produce graphs that are not regular. In this talk, we will examine when they are giving regular graphs with prescribed girth and compare these two constructions. We provide sufficient conditions under which a  $G$ -graph can be obtained as a voltage assignment. In addition, we generalize two families of graphs important in the degree-girth problem which were constructed as  $G$ -graphs, after understanding their description as voltage assignments, for richer families.

*We acknowledge the support from the Slovak Research and Development Agency under the grants APVV 19-0308, APVV 22-0005, and the Scientific Grant Agency of the Slovak Republic under the grants VEGA 1/0567/22, and VEGA 1/0069/23.*