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Testing whether the lifted group splits

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Abstract: Let a group of automorphisms lift along a regular covering projection of connected graphs given combinatorially by means of voltages. The data that determine the lifted group and its action are then conveniently encoded in terms of voltages as well. Along these lines, an algorithm for testing whether the lifted group is a split extension of the group of covering transformations has recently been proposed in the case when the group of covering transformations is solvable. It consists of decomposing the covering into a series of coverings with elementary abelian groups of covering transformations, and inductively solving the problem at every elementary abelian step. Although the explicit construction of the lifted group is not needed, it still involves time and space consuming constructions of certain subgroups in the lifted group at every step except at the final one.

In this paper, an improved version that completely avoids such constructions is presented. From voltage distribution we first compute the weak action and the factor set that determine the lifted group, and we then carry out the test by extracting the

necessary information only from the corresponding weak actions and factor sets at every step. An experimental comparison is made against the previous version.

Keywords: Algorithm, graph, group extension, lifting automorphisms, regular covering projection, voltages.

Math. Subj. Class.: 05C50, 05E18, 20B40, 20B25, 20K35, 57M10

Testiranje razcepnosti dvignjene grupe

Povzetek: Naj se grupa avtomorfizmov dvigne vzdolž regularne krovne projekcije povezanih grafov, podane kombinatorično z napetostmi. Tedaj so podatki, ki določajo dvignjeno grupo in njeno delovanje, prav tako zakodirani s pomočjo napetosti. Ustrezní algoritem za testiranje, ali je dvignjena grupa razcepna razširitev grupe krovnih transformacij, je bil nedavno predstavljen v primeru, ko je grupa krovnih transformacij rešljiva. Sestoji iz dekomponiranja krova v zaporedje krovov z elementarnimi abelovimi grupami krovnih transformacij, in induktivnega reševanja problema na vsakem elementarno abelovem koraku. Čeprav eksplicitna konstrukcija dvignjene grupe ni potrebna, algoritem vseeno vključuje časovno in prostorsko zahtevne konstrukcije določenih podgrup v dvignjeni grupi na vsakem koraku z izjemo zadnjega.

V tem članku predstavimo izboljšano verzijo algoritma, ki se povsem izogne takšnim konstrukcijam. Iz porazdelitve napetosti najprej izračunamo šibko delovanje in faktorsko množico, ki določata dvignjeno grupo, nato pa izpeljemo test tako, da izluščimo potrebno informacijo samo iz ustreznih šibkih delovanj in faktorskih množic na vsakem koraku. Eksperimentalno primerjamo to in prejšnjo verzijo algoritma.

Ključne besede: Algoritem, graf, razširitev grupe, dvig avtomorfizmov, regularna krovna projekcija, napetosti.

