ARS MATHEMATICA CONTEMPORANEA

Also available at http://amc-journal.eu
ISSN 1855-3966 (printed edn.), ISSN 1855-3974 (electronic edn.)
ARS MATHEMATICA CONTEMPORANEA 9 (2015) 27–43

Cycle construction and geodesic cycles with application to the hypercube

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Abstract

Construction of cycles in a graph is investigated, where cycles from particular subsets (such as bases) are added together so that each partial sum is also a cycle or each new cycle intersects the sum of the preceding terms in a nontrivial path. Starting with the geodesic cycles, a hierarchical construction is given. For the hypercube graph, geodesic cycles are characterized, and it is shown how hypercube geodesic cycles can be constructed in two steps from a special basis. Applications are given to inferring commutativity of a diagram in a groupoid from commutativity of some of its cycles.

Keywords: Robust cycle basis, well-arranged sequence, geodesic cycle, Cayley graph, hypercube, forcing commutativity, groupoid diagram.

Math. Subj. Class.: 05C38, 18B40

Konstrukcija ciklov in geodetskih ciklov ter njene uporabe pri hiperkocki

Povzetek

Raziskujemo konstrukcijo ciklov v grafu, pri čemer se cikli iz posebnih podmnožic (kot so npr. baze) seštevajo tako, da je vsaka delna vsota tudi cikel ali pa vsak nov cikel seka vsoto prejšnjih členov v netrivialni poti. Izhajajoč iz geodetskih ciklov postavimo hierarhično konstrukcijo. Za graf hiperkocke karakteriziramo geodetske cikle in pokažemo, kako jih lahko konstruiramo v dveh korakih iz posebne baze. Ena od uporab: komutativnost diagrama v grupoidu sledi iz komutativnosti nekaterih od njegovih ciklov.

Ključne besede: Robustna baza ciklov, dobro-urejeno zaporedje, geodetski cikel, Cayleyev graf, hiperkocka, vsiljena komutativnost, grupoidni diagram.