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Large circulant graphs of fixed diameter and arbitrary degree

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Abstract: We consider the degree-diameter problem for undirected and directed circulant graphs. To date, attempts to generate families of large circulant graphs of arbitrary degree for a given diameter have concentrated mainly on the diameter 2 case. We present a direct product construction yielding improved bounds for small diameters and introduce a new general technique for “stitching” together circulant graphs which enables us to improve the current best known asymptotic orders for every diameter. As an application, we use our constructions in the directed case to obtain upper bounds on the minimum size of a subset A of a cyclic group of order n such that the k -fold sumset kA is equal to the whole group. We also present a revised table of largest known circulant graphs of small degree and diameter.

Keywords: Degree-diameter problem, Cayley graphs, circulant graphs, sumsets.

Math. Subj. Class.: 05C25, 05C35

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Veliki cirkulantni grafi fiksnega premera in poljubne stopnje

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Povzetek: Obravnavamo problem, ki se nanaša na stopnjo in premer neusmerjenih in usmerjenih cirkulantnih grafov. Doslej so se poskusi generirati družine velikih cirkulantnih grafov poljubne stopnje pri danem premeru osredotočali predvsem na primer, ko je premer 2. Predstavimo konstrukcijo z direktnim produktom, ki da izboljšane meje za majhne premere in vpeljemo novo splošno tehniko za “šivanje” cirkulantnih grafov, ki nam omogoča izboljšavo trenutno najboljših znanih asimptotskih redov za vsak premer. Kot primer aplikacije, z uporabo naše konstrukcije v usmerjenem primeru dobimo zgornje meje za minimalno velikost podmnožice A ciklične grupe reda n , takšne da je k -listna vsota množic kA enaka celotni grupi. Predstavimo tudi popravljeno tabelo največjih znanih cirkulantnih grafov majhne stopnje in premera.

Ključne besede: Problem stopenj in premera, Cayleyevi grafi, cirkulantni grafi, vsote množic.

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