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## New bounds for the sum of powers of normalized Laplacian eigenvalues of graphs

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**Abstract:** For a simple and connected graph, a new graph invariant  $s_\alpha^*(G)$ , defined as the sum of  $\alpha$  powers of the eigenvalues of the normalized Laplacian matrix, has been introduced by Bozkurt and Bozkurt (2012). Lower and upper bounds for this index have been proposed by the authors. In this paper, we localize the eigenvalues of the normalized Laplacian matrix by adapting a theoretical method, proposed in Bianchi and Torriero (2000), based on majorization techniques. Through this approach we derive upper and lower bounds of  $s_\alpha^*(G)$ . Some numerical examples show how sharper results can be obtained with respect to those existing in literature.

**Keywords:** Graphs, majorization, topological indices, bounds.

Math. Subj. Class.: 05C35, 05C05, 05C50



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## Nove meje za vsoto potenc lastnih vrednosti normalizirane Laplaceove matrike grafov

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**Povzetek:** Bozkurt in Bozkurt (2012) sta za enostaven in povezan graf vpeljala novo invarianto  $s_\alpha^*(G)$ , definirano kot vsoto  $\alpha$  potenc lastnih vrednosti normalizirane Laplaceove matrike. Avtorja sta našla spodnje in zgornje meje za ta indeks.

V tem članku lokaliziramo lastne vrednosti normalizirane Laplaceove matrike z uporabo teoretične metode, ki sta jo razvila Bianchi in Torriero (2000), in je osnovana na majorizacijskih tehnikah. S tem pristopom izpeljemo zgornje in spodnje meje za  $s_\alpha^*(G)$ . Nekaj numeričnih primerov pokaže, kako je mogoče dobiti ostrejšje rezultate v primerjavi s tistimi, ki obstajajo v literaturi.

**Ključne besede:** Grafi, majorizacija, topološki indeksi, meje.

Math. Subj. Class.: 05C35, 05C05, 05C50