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On the skew Laplacian spectral radius of a digraph

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Let $\mathbf{G}$ be an orientation of a simple graph G with n vertices and m edges. The skew Laplacian matrix $\mathrm{SL}(\mathbf{G})$ of the digraph $\mathbf{G}$ is defined as $\mathrm{SL}(\mathbf{G}) = \widetilde{D}(\mathbf{G}) - iS(\mathbf{G})$, where $i = \sqrt{-1}$ is the imaginary unit, $\widetilde{D}(\mathbf{G})$ is the diagonal matrix with oriented degrees $\alpha_i = d_i^+ - d_i^-$ as diagonal entries and $S(\mathbf{G})$ is the skew matrix of the digraph $\mathbf{G}$. The largest eigenvalue of the matrix $\mathrm{SL}(\mathbf{G})$ is called skew Laplacian spectral radius of the digraph $\mathbf{G}$. In this paper, we study the skew Laplacian spectral radius of the digraph $\mathbf{G}$. We obtain some sharp lower and upper bounds for the skew Laplacian spectral radius of a digraph $\mathbf{G}$, in terms of different structural parameters of the digraph and the underlying graph. We characterize the extremal digraphs attaining these bounds in some cases. Further, we end the paper with some problems for the future research in this direction.

Keywords: Digraph; skew Laplacian matrix; skew-Laplacian spectral radius; skew matrix.

Mathematics Subject Classification 2000: 05C50, 05C12, 05C30, 15A18

1. Introduction

Consider a simple graph G with n vertices and m edges having the vertex set $V = \{v_1, v_2, \ldots, v_n\}$. Let $\mathbf{G}$ be a digraph obtained by assigning arbitrarily direction