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On skew Laplacian spectrum and energy of digraphs

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We consider the skew Laplacian matrix of a digraph $\overrightarrow{G}$ obtained by giving an arbitrary direction to the edges of a graph G having n vertices and m edges. With $\nu_1, \nu_2, \ldots, \nu_n$ to be the skew Laplacian eigenvalues of $\overrightarrow{G}$, the skew Laplacian energy $\mathrm{SLE}(\overrightarrow{G})$ of $\overrightarrow{G}$ is defined as $\mathrm{SLE}(\overrightarrow{G}) = \sum_{i=1}^{n} |\nu_i|$. In this paper, we analyze the effect of changing the orientation of an induced subdigraph on the skew Laplacian spectrum. We obtain bounds for the skew Laplacian energy $\mathrm{SLE}(\overrightarrow{G})$ in terms of various parameters associated with the digraph $\overrightarrow{G}$ and the underlying graph G and we characterize the extremal digraphs attaining these bounds. We also show these bounds improve some known bounds for some families of digraphs. Further, we show the existence of some families of skew Laplacian equienergetic digraphs.

Keywords: Digraph; skew Laplacian matrix; skew Laplacian spectrum; skew Laplacian energy.

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