The Laplacians, Kirchhoff index and complexity of linear Möbius and cylinder octagonal-quadrilateral networks

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Abstract

Spectrum graph theory not only facilitate comprehensively reflect the topological structure and dynamic characteristics of networks, but also offer significant and noteworthy applications in theoretical chemistry, network science and other fields. Let $L_n(8, 4)$ represent a linear octagonal-quadrilateral network, consisting of $n$ eight-member ring and $n$ four-member ring. The Möbius graph $Q_n(8, 4)$ is constructed by reverse identifying the opposite edges, whereas cylinder graph $Q'_n(8, 4)$ identifies the opposite edges by order. In this paper, the explicit formulas of Kirchhoff indices and complexity of $Q_n(8, 4)$ and $Q'_n(8, 4)$ are demonstrated by Laplacian characteristic polynomials according to decomposition theorem and Vieta’s theorem. In surprise, the Kirchhoff index of $Q_n(8, 4)$($Q'_n(8, 4)$) is approximately one-third half of its Wiener index as $n \to \infty$.

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