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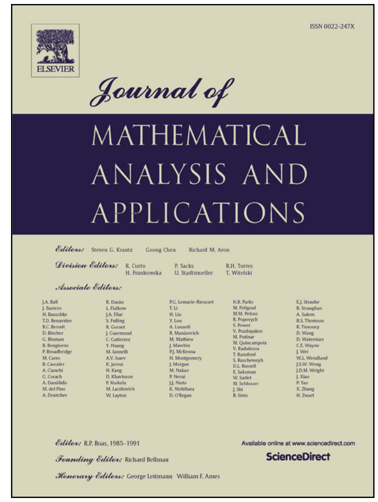

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ACCEPTED MANUSCRIPT

On the maximal connective eccentricity index of bipartite graphs with some given parameters*

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Abstract: The connective eccentricity index is a novel graph invariant with vast potential in structure activity/property relationships. This graph invariant displays high discriminating power with respect to both biological activity and physical properties. Given a simple connected graph G, the connective eccentricity index (CEI) of G is defined as $\xi^{ee}(G) = \sum_{uv\in E_G}(\frac{1}{\varepsilon_G(u)} + \frac{1}{\varepsilon_G(v)})$, where $\varepsilon_G(\cdot)$ denotes the eccentricity of the corresponding vertex. In this paper, we first determine the sharp upper bound on the CEI of graphs in the class of all n-vertex connected bipartite graphs with matching number q, the maximum CEI is realized only by the graph $K_{q,n-q}$. Second, we characterize the graph with the maximum CEI in the class of all the n-vertex connected bipartite graphs of given diameter. Finally, all the extremal graphs having the maximum CEI in the class of all the connected n-vertex bipartite graphs with a given connectivity s are identified as well.

Keywords: Reciprocal edge-eccentricity; Bipartite graph; Matching number; Diameter; Connectivity

2010 AMS subject classification: 05C05

1. Introduction

In this paper, we consider connected, simple and undirected graphs. Let G be a simple connected graph with vertex set V_G and edge set E_G. We follow the notations and terminologies in [2] except if otherwise stated.

The *distance*, $d_G(u, v)$, between two vertices u, v of G is the length of a shortest u-v path in G. The *eccentricity* $\varepsilon_G(v)$ of a vertex v is the distance between v and a furthest vertex from v. The *diameter* of G is defined as the maximum of the eccentricities of vertices of G. For any edge $e = uv \in E_G$, we may define *edge-eccentricity* of e as $ec(e) = \varepsilon_G(u) + \varepsilon_G(v)$; whereas its *reciprocal edge-eccentricity* is defined as $ree(e) = \frac{1}{\varepsilon_G(u)} + \frac{1}{\varepsilon_G(v)}$; see [29]. When the graph is clear from the context, we will omit the subscript G from the notation.

Molecular descriptors play an important role in mathematical chemistry, especially in the QSPR and QSAR modeling [1]. Among them, a special place is reserved for the so-called topological indices, or graph invariants. The best-studied distance-based graph invariant probably is the *Wiener index* [39], one of the most common chemical indices that correlates a chemical compound's structure with the compound's physical-chemical properties. The Wiener index, introduced in 1947, is defined as the sum of distances between all pairs of vertices, i.e., $W(G) = \sum_{\{u,v\}\subseteq V_G} d_G(u, v)$. For more results on the Wiener index one may be referred to those in [11, 22–24, 26, 36] and the references therein.

Another distance-based graph invariant, defined in a fully analogous manner to Wiener index, is the *Harary index* [19, 34], which is equal to the sum of reciprocal distances over all unordered vertex pairs in G, i.e., $H(G) = \sum_{\{u,v\}\subseteq V_G} \frac{1}{d_G(u,v)}$. For more results on the Harary index, one may be referred to [4, 18, 21, 30, 34, 40].

More recently, the distance-based graph invariants involving eccentricity have attracted more and more attention. These graph invariants mainly include the *average eccentricity* [3, 15], the *superaugmented eccentric*

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