

CENTROSYMMETRIC GRAPHS AND A LOWER BOUND FOR GRAPH ENERGY OF FULLERENES

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Abstract

The energy of a molecular graph G is defined as the summation of the absolute values of the eigenvalues of adjacency matrix of a graph G . In this paper, an infinite class of fullerene graphs with $10n$ vertices, $n \geq 2$, is considered. By proving centrosymmetry of the adjacency matrix of these fullerene graphs, a lower bound for its energy is given. Our method is general and can be extended to other class of fullerene graphs.

Keywords: centrosymmetric matrix, fullerene graph, energy.

2010 Mathematics Subject Classification: 05C35, 05C50, 92E10.

REFERENCES

- [1] A. Cantoni and P. Buter, *Eigenvalues and eigenvectors of symmetric centrosymmetric matrices*, Linear Algebra Appl. **13** (1976) 275–288.
doi:10.1016/0024-3795(76)90101-4
- [2] D. Cvetković, M. Doob, I. Gutman and A. Torgašev, Recent Results in the Theory of Graph Spectra (North-Holland Publishing Co., Amsterdam, 1988).
- [3] D. Cvetković, P. Rowlinson and S. Simić, An Introduction to the Theory of Graph Spectra (Cambridge University Press, Cambridge, 2010).
- [4] P.W. Fowler and D.E. Manolopoulos, An Atlas of Fullerenes (Clarendon Press, Oxford, 1995).
- [5] P.W. Fowler and W. Myrvold, *Most fullerenes have no centrosymmetric labelling*, MATCH Commun. Math. Comput. Chem. **71** (2014) 93–97.
- [6] A. Graovac, O. Ori, M. Faghani and A.R. Ashrafi, *Distance property of fullerenes*, Iranian J. Math. Chem. **2** (2011) 99–107.
- [7] I. Gutman, *The energy of a graph*, Ber. Math.-Statist. Sekt. Forsch. Graz **103** (1978) 1–22.
- [8] I. Gutman, *Bounds for all graph energies*, Chem. Phys. Lett. **528** (2012) 72–74.
- [9] I. Gutman and B. Zhou, *Laplacian energy of a graph*, Linear Algebra Appl. **414** (2006) 29–37.
doi:10.1016/j.laa.2005.09.008
- [10] I. Gutman, S. Zare Firoozabadi, J.A. de la Peña and J. Rada, *On the energy of regular graphs*, MATCH Commun. Math. Comput. Chem. **57** (2007) 435–442.
- [11] H. Hua, M. Faghani and A.R. Ashrafi, *The Wiener and Wiener polarity indices of a class of fullerenes with exactly $12n$ carbon atoms*, MATCH Commun. Math. Comput. Chem. **71** (2014) 361–372.
- [12] H.W. Kroto, J.R. Heath, S.C. O’Brien, R.F. Curl and R.E. Smalley, *C_{60} : buckminsterfullerene*, Nature **318** (1985) 162–163.
doi:10.1038/318162a0
- [13] Z. Liu and H. Faßbender, *Some properties of generalized K-centrosymmetric H-matrices*, J. Comput. Appl. Math. **215** (2008) 38–48.
doi:10.1016/j.cam.2007.03.026
- [14] Z.-Y. Liu, *Some properties of centrosymmetric matrices*, Appl. Math. Comput. **141** (2003) 297–306.
doi:10.1016/S0096-3003(02)00254-0
- [15] V. Nikiforov, *The energy of graphs and matrices*, J. Math. Anal. Appl. **326** (2007) 1472–1475.
doi:10.1016/j.jmaa.2006.03.072
- [16] O. Rojo and H. Rojo, *Some results on symmetric circulant matrices and on symmetric centrosymmetric matrices*, Linear Algebra Appl. **392** (2004) 211–233.
doi:10.1016/j.laa.2004.06.013

Received 9 April 2013
Revised 13 September 2013
Accepted 10 November 2013