Discussiones Mathematicae
Graph Theory 39 (2019) 241–256
doi:10.7151/dmgt.2066

Full PDF

DMGT Page

DECOMPOSITION OF THE PRODUCT OF CYCLES BASED ON DEGREE PARTITION

Y.M. Borse and S.R. Shaikh

Department of Mathematics
Savitribai Phule Pune University
Pune-411007, India

e-mail: ymborse11@gmail.com
shazia_31082@yahoo.co.in

Abstract

The Cartesian product of n cycles is a $2n$-regular, $2n$-connected and bipancyclic graph. Let G be the Cartesian product of n even cycles and let $2n = n_1 + n_2 + \cdots + n_k$ with $k \geq 2$ and $n_i \geq 2$ for each i. We prove that if $k = 2$, then G can be decomposed into two spanning subgraphs G_1 and G_2 such that each G_i is n_i-regular, n_i-connected, and bipancyclic or nearly bipancyclic. For $k > 2$, we establish that if all n_i in the partition of $2n$ are even, then G can be decomposed into k spanning subgraphs $G_1, G_2, \ldots, G_k$ such that each G_i is n_i-regular and n_i-connected. These results are analogous to the corresponding results for hypercubes.

Keywords: hypercube, Cartesian product, n-connected, regular, bipancyclic, spanning subgraph.

2010 Mathematics Subject Classification: 05C40, 05C70, 68R10.

References

[1] B. Alspach, J.-C. Bermond and D. Sotteau, *Decomposition into cycles* I*: Hamilton decompositions*, in: Cycles and Rays, G. Hahn, G. Sabidussi and R.E. Woodrow (Ed(s)), (Springer, Dordrecht, 1990) 9–18.
doi:10.1007/978-94-009-0517-7_2

[2] B. Alspach and M. Dean, *Honeycomb toroidal graphs are Cayley graphs*, Inform. Process. Lett. **109** (2009) 705–708.
doi:10.1016/j.ipl.2009.03.009

[3] Y.M. Borse and S.A. Kandekar, *Decomposition of hypercubes into regular connected bipancyclic subgraphs*, Discrete Math. Algorithms Appl. **7(3)** (2015) Article 1550033.
doi:10.1142/S1793830915500330

[4] Y.M. Borse, A.V. Sonawane and S.R. Shaikh, *Connected bipancyclic isomorphic m-factorizations of the Cartesian product of graphs*, Australas. J. Combin. **66** (2016) 120–129.

[5] Y.M. Borse and B.N. Waphare, *On removable and non-separating even cycles in graphs*, J. Indian Math. Soc. **80** (2013) 221–234.

[6] X.-B. Chen, *Panconnectivity and edge-pancyclicity of multidimensional torus networks*, Discrete Appl. Math. **178** (2014) 33–45.
doi:10.1016/j.dam.2014.06.021

[7] S.I. El-Zanati and C.V. Eynden, *Cycle factorizations of cycle products*, Discrete Math. **189** (1998) 267–275.
doi:10.1016/S0012-365X(98)00053-3

[8] M.F. Foregger, *Hamiltonian decompositions of products of cycles*, Discrete Math. **24** (1978) 251–260.
doi:10.1016/0012-365X(78)90096-1

[9] B. Jackson, *Removable cycles in* 2*-connected graphs of minimum degree at least four*, J. Lond. Math. Soc.(2) **21** (1980) 385–392.
doi:10.1112/jlms/s2-21.3.385

[10] A. Kotzig, Every Cartesian product of two circuits is decomposable into two Hamiltonian circuits (Centre de Recherches Mathématiques, Montréal, 1973).

[11] F.T. Leighton, Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes (Morgan Kaufmann, 1992).

[12] T.-K. Li, C.-H. Tsai, J.J.-M. Tan and L.-H. Hsu, *Bipanconnectivity and edge fault-tolerant bipancyclicity of hypercubes*, Inform. Process. Lett. **87** (2003) 107–110.
doi:10.1016/S0020-0190(03)00258-8

[13] W. Mader, *Kreuzungsfreie* a,b*-Wege in endlichen Graphen*, Abh. Math. Semin. Univ. Hambg. **42** (1974) 187–204.
doi:10.1007/BF02993546

[14] W. Mader, *Connectivity and edge-connectivity in finite graphs*, in: Surveys in Combinatorics, B. Bollobás (Ed(s)), (Cambridge University Press, 1979) 66–95.
doi:10.1017/CBO9780511662133.005

[15] A.V. Sonawane and Y.M. Borse, *Decomposing hypercubes into regular connected subgraphs*, Discrete Math. Algorithms Appl. **8(4)** (2016) Article 1650065.
doi:10.1142/S1793830916500658

[16] M. Xu, J.-M. Xu, X.-M. Hou, *Fault diameter of Cartesian product graphs*, Inform. Process. Lett. **93** (2005) 245–248.
doi:10.1016/j.ipl.2004.11.005

Received 10 October 2016
Revised 21 July 2017
Accepted 21 July 2017