



# Decomposition of product graphs into 4-kites

K. SOWNDHARIYA, M. ILAYARAJA, AND A. MUTHUSAMY

**Abstract.** An  $n$ -kite is an  $n$ -cycle with a tail consisting of a single edge. In this paper, it is shown that the necessary conditions are sufficient for the existence of 4-kite decompositions of tensor and Cartesian products of complete graphs. Further we extend the existence of such decompositions in regular  $m$ -partite graphs.

## References

- [1] J. C. Bermond, C. Huang, A. Rosa, and D. Sotteau, Decomposition of complete graphs into isomorphic subgraphs with five vertices, *Ars Combin.* **10** (1980), 211–254.
- [2] J. C. Bermond and J. Schonheim,  $G$ -decomposition of  $K_n$ , where  $G$  has four vertices or less, *Discrete Math.* **19** (1977), 113–120.
- [3] P. Bonacini, M. Gionfriddo, and L. Marino, Equitable block coloring for systems of 4-kites, *Appl. Math. Sci.* **11** (2017), no. 21, 1029–1047.
- [4] C. J. Colbourn, A. C. H. Ling, and G. Quattrocchi, Embedding path designs into kite systems, *Discrete Math.* **297** (2005), 38–48.
- [5] C. M. Fu, Y. F. Hsu, S. W. Lo, and W. C. Huang, Some gregarious kite decomposition of complete equipartite graphs, *Discrete Math.* **313** (2013), 726–732.
- [6] M. Gionfriddo and S. Kucukcifici, and L. Milazzo, Balanced and strongly balanced 4-kite designs, *Util. Math.* **91** (2013), 121–129.
- [7] L. Gionfriddo and C. C. Lindner, Nesting kite and 4-cycle systems, *Australasian J. Combin.* **33** (2005), 247–254.
- [8] M. Gionfriddo and S. Milici, On the existence of uniformly resolvable decompositions of  $K_n$  and  $K_n - I$  into paths and kites, *Discrete Math.* **313** (2013), 2830–2834.

- [9] S. Kucukcifici and C. C. Lindner, The metamorphosis of  $\lambda$ -fold block designs with block size four into  $\lambda$ -fold kite systems, *J. Combin. Math. Combin. Comput.* **40** (2002), 241–252.
- [10] C. C. Lindner and C. A. Rodger, *Design Theory*, Chapman & Hall/CRC Press, Taylor & Francis Group, Boca Raton, 2009.
- [11] G. Lo Faro and A. Tripodi, The Doyen-Wilson theorem for kite systems, *Discrete Math.* **306** (2006), 2695–2701.
- [12] G. Ragusa, Complete simultaneous metamorphosis of  $\lambda$ -fold kite systems, *J. Combin. Math. Combin. Comput.* **73** (2010), 159–180.
- [13] A. Tamil Elakkiya and A. Muthusamy, Gregarious kite decomposition of tensor product of complete graphs, *Electron. J. Discrete Math.* **53** (2016), 83–96.
- [14] A. Tamil Elakkiya and A. Muthusamy, Gregarious kite factorization of tensor product of complete graphs, *Discuss. Math. Graph Theory* **40**(1) (2019), 7–24.
- [15] L. Wang, On the existence of resolvable  $(K_3 + e)$ -group divisible designs, *Graphs Combin.* **26** (2010), 879–889.
- [16] H. Wang and Y. Chang, Kite-group divisible designs of type  $g^t u^1$ , *Graphs Combin.* **22** (2006), 545–571.
- [17] H. Wang and Y. Chang,  $(K_3 + e, \lambda)$ -group divisible designs of type  $g^t u^1$ , *Ars Combin.* **89** (2008), 63–88.

K. SOWNDHARIYA  
 DEPARTMENT OF MATHEMATICS,  
 DHIRAJLAL GANDHI COLLEGE OF TECHNOLOGY,  
 SALEM, TAMIL NADU, INDIA  
 sowndharyak@gmail.com

M. ILAYARAJA  
 DEPARTMENT OF MATHEMATICS,  
 SONA COLLEGE OF ARTS AND SCIENCE,  
 SALEM, TAMIL NADU, INDIA  
 ilayamaths@gmail.com

A. MUTHUSAMY  
 DEPARTMENT OF MATHEMATICS,  
 SONA COLLEGE OF TECHNOLOGY,  
 SALEM, TAMIL NADU, INDIA  
 appumuthusamy@gmail.com