Discussiones Mathematicae
Graph Theory 40 (2020) 695–712
doi:10.7151/dmgt.2137

POWER DOMINATION IN THE GENERALIZED PETERSEN GRAPHS[1]

Min Zhao

College of Science
China Jiliang University
Hangzhou 310018, Zhejiang, P.R. China

e-mail: minzhao@126.com

Erfang Shan[2] and Liying Kang

Department of Mathematics
Shanghai University
Shanghai 200444, P.R. China

e-mail: efshan@i.shu.edu.cn
lykang@shu.edu.cn

Abstract

The problem of monitoring an electric power system by placing as few measurement devices in the system can be formulated as a power dominating set problem in graph theory. The power domination number of a graph is the minimum cardinality of a power dominating set. Xu and Kang [*On the power domination number of the generalized Petersen graphs*, J. Comb. Optim. 22 (2011) 282–291] study the exact power domination number for the generalized Petersen graph $P(3k, k)$, and propose the following problem: determine the power domination number for the generalized Petersen graph $P(4k, k)$ or $P(ck, k)$. In this paper we give the power domination number for $P(4k, k)$ and present a sharp upper bound on the power domination number for the generalized Petersen graph $P(ck, k)$.

Keywords: power domination, domination, generalized Petersen graph, electric power system.

2010 Mathematics Subject Classification: 05C69, 05C90.

[1]Research was partially supported by the ZJNSF of China (grant number LQ14A010014) and NSFC (No. 11971298).
[2]Corresponding author.

References

[1] R. Barrera and D. Ferrero, *Power domination in cylinders, tori, and generalized Petersen graphs*, Networks **58** (2011) 43–49.
doi:10.1002/net.20413

[2] A. Behzad, M. Behzad and C.E. Praeger, *On the domination number of the generalized Petersen graphs*, Discrete Math. **308** (2008) 603–610.
doi:10.1016/j.disc.2007.03.024

[3] D.J. Brueni and L.S. Heath, *The PMU placement problem*, SIAM J. Discrete Math. **19** (2005) 744–761.
doi:10.1137/S0895480103432556

[4] P. Dorbec, M. Mollard, S. Klavžar and S. Špacapan, *Power domination in product graphs*, SIAM J. Discrete Math. **22** (2008) 554–567.
doi:10.1137/060661879

[5] J. Fox, R. Gera and P. Stănică, *The independence number for the generalized Petersen graphs*, Ars Combin. **103** (2012) 439–451.

[6] J. Guo, R. Niedermeier and D. Raible, *Improved algorithms and complexity results for power domination in graphs*, Lecture Notes in Comput. Sci. **3623** (2005) 172–184.
doi:10.1007/11537311_16

[7] T.W. Haynes, S.M. Hedetniemi, S.T. Hedetniemi, and M.A. Henning, *Domination in graphs applied to electric power networks*, SIAM J. Discrete Math. **15** (2002) 519–529.
doi:10.1137/S0895480100375831

[8] T.W. Haynes, S.T. Hedetniemi and P.J. Slater, Fundamentals of Domination in Graphs (Marcel Dekker, New York, 1998).

[9] W.K. Hon, C.S. Liu, S.L. Peng and C.Y. Tang, *Power domination on block-cactus graphs*, in: The 24th Workshop on Combinatorial Mathematics and Computation Theory (2007) 280–284.

[10] C.S. Liao and D.T. Lee, *Power domination problem in graphs*, Lecture Notes in Comput. Sci. **3595** (2005) 818–828.
doi:10.1007/11533719_83

[11] C.S. Liao and D.T. Lee, *Power domination in circular-arc graphs*, Algorithmica **65** (2013) 443–466.
doi:10.1007/s00453-011-9599-x

[12] K.J. Pai, J.M. Chang and Y.L. Wang, *A simple algorithm for solving the power domination problem on grid graphs*, in: The 24th Workshop on Combinatorial Mathematics and Computation Theory (2007) 256–260.

[13] Y.L. Wang and G.S. Huang, An Algorithm for Solving the Power Domination Problem on Honeycomb Meshes (Master Thesis, Department of Computer Science and Information Engineering, National Chi Nan University, 2009).

[14] H.L. Wang, X.R. Xu, Y.S. Yang and K. Lü, *On the distance pair domination of generalized Petersen graphs $P(n,1)$ and $P(n,2)$*, J. Comb. Optim. **21** (2011) 481–496.
doi:10.1007/s10878-009-9266-1

[15] G. Xu, L. Kang, E. Shan and M. Zhao, *Power domination in block graphs*, Theoret. Comput. Sci. **359** (2006) 299–305.
doi:10.1016/j.tcs.2006.04.011

[16] G. Xu and L. Kang, *On the power domination number of the generalized Petersen graphs*, J. Comb. Optim. **22** (2011) 282–291.
doi:10.1007/s10878-010-9293-y

[17] H. Yan, L. Kang and G. Xu, *The exact domintion number of the generalized Petersen graphs*, Discrete Math. **309** (2009) 2596–2607.
doi:10.1016/j.disc.2008.04.026

[18] B. Zelinka, *Domination in generalized Petersen graphs*, Czechoslovak Math. J. **52** (2002) 11–16.
doi:10.1023/A:1021759001873

[19] M. Zhao, L. Kang and G.J. Chang, *Power domination in graphs*, Discrete Math. **306** (2006) 1812–1816.
doi:10.1016/j.disc.2006.03.037

Received 31 July 2017
Revised 26 February 2018
Accepted 26 February 2018