TETRAVALENT ARC-TRANSITIVE GRAPHS OF ORDER $3p^2$

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Abstract

Let s be a positive integer. A graph is s -transitive if its automorphism group is transitive on s -arcs but not on $(s + 1)$ -arcs. Let p be a prime. In this article a complete classification of tetravalent s -transitive graphs of order $3p^2$ is given.

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REFERENCES

- [1] Y.G. Baik, Y.-Q. Feng, H.S. Sim and M.Y. Xu, *On the normality of Cayley graphs of abelian groups*, Algebra Colloq. **5** (1998) 297–304.
- [2] N. Biggs, Algebraic Graph Theory, Second Ed. (Cambridge University Press, Cambridge, 1993).
- [3] W. Bosma, C. Cannon and C. Playoust, *The MAGMA algebra system I: the user language*, J. Symbolic Comput. **24** (1997) 235–265.
doi:10.1006/jsco.1996.0125
- [4] C.Y. Chao, *On the classification of symmetric graphs with a prime number of vertices*, Trans. Amer. Math. Soc. **158** (1971) 247–256.
doi:10.1090/S0002-9947-1971-0279000-7
- [5] Y. Cheng and J. Oxley, *On weakly symmetric graphs of order twice a prime*, J. Combin. Theory (B) **42** (1987) 196–211.
doi:10.1016/0095-8956(87)90040-2
- [6] M. Conder, *Orders of symmetric cubic graphs*, The Second International Workshop on Group Theory and Algebraic Combinatorics, (Peking University, Beijing, 2008).

- [7] M. Conder and C.E. Praeger, *Remarks on path-transitivity on finite graphs*, European J. Combin. **17** (1996) 371–378.
doi:10.1006/eujc.1996.0030
- [8] D.Ž. Djoković and G.L. Miller, *Regular groups of automorphisms of cubic graphs*, J. Combin. Theory (B) **29** (1980) 195–230.
doi:10.1016/0095-8956(80)90081-7
- [9] Y.-Q. Feng and J.H. Kwak, *One-regular cubic graphs of order a small number times a prime or a prime square*, J. Aust. Math. Soc. **76** (2004) 345–356.
doi:10.1017/S1446788700009903
- [10] Y.-Q. Feng and J.H. Kwak, *Classifying cubic symmetric graphs of order $10p$ or $10p^2$* , Sci. China (A) **49** (2006) 300–319.
doi:10.1007/s11425-006-0300-9
- [11] Y.-Q. Feng and J.H. Kwak, *Cubic symmetric graphs of order twice an odd prime power*, J. Aust. Math. Soc. **81** (2006) 153–164.
doi:10.1017/S1446788700015792
- [12] Y.-Q. Feng and J.H. Kwak, *Cubic symmetric graphs of order a small number times a prime or a prime square*, J. Combin. Theory (B) **97** (2007) 627–646.
doi:10.1016/j.jctb.2006.11.001
- [13] Y.-Q. Feng, J.H. Kwak and K.S. Wang, *Classifying cubic symmetric graphs of order $8p$ or $8p^2$* , European J. Combin. **26** (2005) 1033–1052.
doi:10.1016/j.ejc.2004.06.015
- [14] R. Frucht, *A one-regular graph of degree three*, Canad. J. Math. **4** (1952) 240–247.
doi:10.4153/CJM-1952-022-9
- [15] A. Gardiner and C.E. Praeger, *On 4-valent symmetric graphs*, European. J. Combin. **15** (1994) 375–381.
doi:10.1006/eujc.1994.1041
- [16] A. Gardiner and C.E. Praeger, *A characterization of certain families of 4-valent symmetric graphs*, European. J. Combin. **15** (1994) 383–397.
doi:10.1006/eujc.1994.1042
- [17] M. Ghasemi, *A classification of tetravalent one-regular graphs of order $3p^2$* , Colloq. Math. **128** (2012) 15–24.
doi:10.4064/cm128-1-3
- [18] M. Ghasemi and J.-X. Zhou, *Tetravalent s -transitive graphs of order $4p^2$* , Graphs Combin. **29** (2013) 87–97.
doi:10.007/s00373-011-1093-3
- [19] D. Gorenstein, *Finite Simple Groups* (Plenum Press, New York, 1982).
doi:10.1007/978-1-4684-8497-7
- [20] C.H. Li, *Finite s -arc-transitive graphs*, The Second International Workshop on Group Theory and Algebraic Combinatorics, (Peking University, Beijing, 2008).

- [21] C.H. Li, *The finite vertex-primitive and vertex-biprimitive s -transitive graphs for $s \geq 4$* , Trans. Amer. Math. Soc. **353** (2001) 3511–3529.
doi:10.1090/S0002-9947-01-02768-4
- [22] C.H. Li, Z.P. Lu and D. Marušič, *On primitive permutation groups with small sub-orbits and their orbital graphs*, J. Algebra **279** (2004) 749–770.
doi:10.1016/j.jalgebra.2004.03.005
- [23] C.H. Li, Z.P. Lu and H. Zhang, *Tetravalent edge-transitive Cayley graphs with odd number of vertices*, J. Combin. Theory (B) **96** (2006) 164–181.
doi:10.1016/j.jctb.2005.07.003
- [24] R.C. Miller, *The trivalent symmetric graphs of girth at most six*, J. Combin. Theory (B) **10** (1971) 163–182.
doi:10.1016/0095-8956(71)90075-X
- [25] P. Potočník, P. Spiga and G. Verret.
<http://www.matapp.unimib.it/spiga/>
- [26] P. Potočník, P. Spiga and G. Verret, *Cubic vertex-transitive graphs on up to 1280 vertices*.
arXiv:1201.5317v1 [math.CO].
- [27] C.E. Praeger, *An O’Nan-Scott theorem for finite quasiprimitive permutation groups and an application to 2-arc transitive graphs*, J. London Math. Soc. **47** (1993) 227–239.
doi:10.1112/jlms/s2-47.2.227
- [28] D.J.S. Robinson, *A Course in the Theory of Groups* (Springer-Verlag, New York, 1982).
- [29] W.T. Tutte, *A family of cubical graphs*, Proc. Camb. Phil. Soc. **43** (1947) 459–474.
doi:10.1017/S0305004100023720
- [30] R.J. Wang and M.Y. Xu, *A classification of symmetric graphs of order $3p$* , J. Combin. Theory (B) **58** (1993) 197–216.
doi:10.1006/jctb.1993.1037
- [31] R. Weiss, *The nonexistence of 8-transitive graphs*, Combinatorica **1** (1981) 309–311.
doi:10.1007/BF02579337
- [32] S. Wilson and P. Potočník, *A Census of edge-transitive tetravalent graphs*.
<http://jan.ucc.nau.edu/swilson/C4Site/index.html>.
- [33] M.Y. Xu, *A note on one-regular graphs*, Chinese Sci. Bull. **45** (2000) 2160–2162.
- [34] J. Xu and M.Y. Xu, *Arc-transitive Cayley graphs of valency at most four on abelian groups*, Southeast Asian Bull. Math. **25** (2001) 355–363.
doi:10.1007/s10012-001-0355-z
- [35] J.-X. Zhou, *Tetravalent s -transitive graphs of order $4p$* , Discrete Math. **309** (2009) 6081–6086.
doi:10.1016/j.disc.2009.05.014

- [36] J.-X. Zhou and Y.-Q. Feng, *Tetravalent s -transitive graphs of order twice a prime power*, J. Aust. Math. Soc. **88** (2010) 277–288.
doi:10.1017/S1446788710000066

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