

## CONSTRUCTION OF COSPECTRAL INTEGRAL REGULAR GRAPHS

RAVINDRA B. BAPAT<sup>1</sup>

*Indian Statistical Institute  
Delhi Centre, 7 S.J.S.S. Marg  
New Delhi 110 016, India*

**e-mail:** rbb@isid.ac.in

AND

MASOUD KARIMI<sup>2</sup>

*School of Mathematical Sciences  
Anhui University, Hefei, China  
and  
Department of Mathematics, Bojnourd Branch  
Islamic Azad University, Bojnourd, Iran  
P.O. Box 94176-94686*

**e-mail:** karimimth@yahoo.com

### Abstract

Graphs  $G$  and  $H$  are called cospectral if they have the same characteristic polynomial. If eigenvalues are integral, then corresponding graphs are called integral graph. In this article we introduce a construction to produce pairs of cospectral integral regular graphs. Generalizing the construction of  $G_4(a, b)$  and  $G_5(a, b)$  due to Wang and Sun, we define graphs  $\mathcal{G}_4(G, H)$  and  $\mathcal{G}_5(G, H)$  and show that they are cospectral integral regular when  $G$  is an integral  $q$ -regular graph of order  $m$  and  $H$  is an integral  $q$ -regular graph of order  $(b - 2)m$  for some integer  $b \geq 3$ .

**Keywords:** eigenvalue, cospectral graphs, adjacency matrix, integral graphs.

**2010 Mathematics Subject Classification:** 05C50.

### REFERENCES

---

<sup>1</sup>This author acknowledges support from JC Bose Fellowship awarded by the Department of Science and Technology, Government of India.

<sup>2</sup>Corresponding author.

- [1] K.T. Balińska, M. Kupczyk, S.K. Simić and K.T. Zwierzyński, On generating all integral graphs on 11 vertices, Computer Science Center Report No. 469, Technical University of Poznań (1999/2000) 1–53.
- [2] K.T. Balińska, M. Kupczyk, S.K. Simić and K.T. Zwierzyński, On generating all integral graphs on 12 vertices, Computer Science Center Report No. 482, Technical University of Poznań (2001) 1–36.
- [3] R.B. Bapat, *Graphs and Matrices* (Springer, 2014).  
doi:10.1007/978-1-4471-6569-9
- [4] A.E. Brouwer and W. Haemers, *Spectra of Graphs* (Springer, 2012).  
doi:10.1007/978-1-4614-1939-6
- [5] F.C. Bussemaker and D.M. Cvetković, *There are exactly 13 connected, cubic, integral graphs*, Univ. Beograd. Publ. Elektrothen **552** (1976) 43–48.
- [6] D.M. Cvetković, M. Doob and H. Sachs, *Spectra of Graphs* (Academic Press, New York, 1980).
- [7] C.D. Godsil and B.D. McKay, *Constructing cospectral graphs*, Aequationes Math. **25** (1982) 257–268.  
doi:10.1007/BF02189621
- [8] A.J. Schwenk, *Exactly thirteen connected cubic graphs have integral spectra*, in: Theory and Applications of Graphs, Y. Alavi and D.R. Lick (Ed(s)), (Springer, 1978) Lecture Notes in Math. **642** 516–533.  
doi:10.1007/bfb0070407
- [9] E.R. van Dam, *Graphs with few eigenvalues; an interplay between combinatorics and algebra* (Ph.D. Thesis, Tilburg University, Center for Economic Research Dissertation Series, No. 20, 1996).
- [10] L. Wang and H. Sun, *Infinitely many pairs of cospectral integral regular graphs*, Appl. Math. J. Chinese Univ. **26** (2011) 280–286.  
doi:10.1007/s11766-011-2180-1
- [11] L. Wang, X. Li and C. Hoede, *Two classes of integral regular graphs*, Ars Combin. **76** (2005) 303–319.
- [12] D.B. West, *Introduction to Graph Theory* (Prentice Hall, Inc., Upper Saddle River, NJ, 1996).

Received 28 December 2015

Revised 27 May 2016

Accepted 27 May 2016