

COLORING OF THE d^{th} POWER OF THE FACE-CENTERED CUBIC GRID

NICOLAS GASTINEAU

LE2I FRE2005, CNRS, Arts et Métiers
Université Bourgogne Franche-Comté
F-21000 Dijon, France

e-mail: nicolas.gastineau@u-bourgogne.fr

AND

Olivier Togni

LIB
Université Bourgogne Franche-Comté
F-21000 Dijon, France

e-mail: olivier.togni@u-bourgogne.fr

Abstract

The face-centered cubic grid is a three dimensional 12-regular infinite grid. This graph represents an optimal way to pack spheres in the three-dimensional space. We give lower and upper bounds on the chromatic number of the d^{th} power of the face-centered cubic grid. In particular, in the case $d = 2$ we prove that the chromatic number of this grid is 13. We also determine sharper bounds for $d = 3$ and for subgraphs of the face-centered cubic grid.

Keywords: face-centered cubic grid, d^{th} power of graph, distance coloring.

2010 Mathematics Subject Classification: 05C15.

REFERENCES

- [1] S. Bjørnholm, *Clusters, condensed matter in embryonic form*, Contemp. Phys. **31** (1990) 309–324.
<https://doi.org/10.1080/00107519008213781>
- [2] J. Bourgeois and S. Copen Goldstein, *Distributed intelligent MEMS: progresses and perspectives*, IEEE Syst. J. **9** (2015) 1057–1068.
<https://doi.org/10.1109/JSYST.2013.2281124>

- [3] J.J. Daymude, R. Gmyr, A.W. Richa, C. Scheideler and T. Strothmann, *Improved leader election for self-organizing programmable matter*, in: Algorithms for Sensor Systems, ALGOSENSORS 2017, Lecture Notes in Comput. Sci. **10718** (2017) 127–140.
https://doi.org/10.1007/978-3-319-72751-6_-10
- [4] G. Fertin, E. Godard and A. Raspaud, *Acyclic and k -distance coloring of the grid*, Inform. Process. Lett. **87** (2003) 51–58.
[https://doi.org/10.1016/S0020-0190\(03\)00232-1](https://doi.org/10.1016/S0020-0190(03)00232-1)
- [5] P. Jacko and S. Jendrol', *Distance coloring of the hexagonal lattice*, Discuss. Math. Graph Theory **25** (2005) 151–166.
<https://doi.org/10.7151/dmgt.1269>
- [6] F. Kramer and H. Kramer, *A survey on the distance-colouring of graphs*, Discrete Math. **308** (2008) 422–426.
<https://doi.org/10.1016/j.disc.2006.11.059>
- [7] B. Piranda and J. Bourgeois, *Geometrical study of a quasi-spherical module for building programmable matter*, in: Distributed Autonomous Robotic Systems, Springer Proc. Adv. Robot. **6** (2018) 347–400.
https://doi.org/10.1007/978-3-319-73008-0_27
- [8] A. Ševčíková, *Distant Chromatic Number of the Planar Graphs* (2001), manuscript.
- [9] P. Šparl, R. Witkowski and J. Žerovník, *Multicoloring of cannonball graphs*, Ars Math. Contemp. **10** (2016) 31–44.
<https://doi.org/10.26493/1855-3974.528.751>

Received 19 June 2018

Revised 30 March 2019

Accepted 1 April 2019