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Recently, it is turned out that discrete-time quantum walks on graphs are efficient for the graph isomorphism problem, and various approach are done in the graph isomorphism problem. Emms, E. R. Hancock, S. Severini and R. C. Wilson treated spectra of the Grover transition matrix of the Grover walk on a graph and its positive support etc, and showed that the positive support of the third power of the Grover transition matrix outperforms the graph spectra methods in distinguishing strongly regular graphs.

We determine the characteristic polynomials of them by using the determinant expressions of zeta function of a graph, and directly present spectra for them. Furthermore, we state the structure of the positive support of the cube of the Grover transition matrix etc. (Received September 16, 2013)