The second path matrix of the graph and its characteristic polynomial

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ABSTRACT. The second path matrix $S(G)$ collects all the second paths in the graph G. Its characteristic polynomial shows some regularity in several particular graphs, such as paths, cycles, stars and complete graphs, as well as in bipartite graphs. Formulas for calculating the characteristic polynomials in these graphs are given. The first eigenvalue of $S(G)$ showed an excellent correlating ability.

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