Merging the A-and Q-spectral theories for digraphs

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Let G be a digraph with adjacency matrix $A(G)$ and let $D(G)$ be the diagonal matrix with outdegrees of vertices of G. For every real $\alpha \in [0,1]$, define the matrix $A_\alpha(G)$ as

$$A_\alpha(G) = \alpha D(G) + (1-\alpha)A(G).$$

The largest modulus of the eigenvalues of $A_\alpha(G)$ is called the A_α spectral radius of G. In this paper, we determine the digraphs which attain the maximum (or minimum) A_α spectral radius among all strongly connected digraphs with given parameters such as girth, clique number, vertex connectivity or arc connectivity. We also discuss a number of open problems.