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Star Complements for Non-main Eigenvalues

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Let G be a finite simple graph of order n with μ as a non-main eigenvalue of multiplicity $k > 0$. Thus the corresponding eigenspace of a $(0, 1)$-adjacency matrix of G has dimension k, and is orthogonal to the all-1 vector in $\mathbb{R}^n$. A *star complement* for μ in G is an induced subgraph of order $n - k$ without μ as an eigenvalue.

We show how such star complements can be used in the context of (i) characterizations of regular graphs, (ii) exceptional graphs, (iii) extremal strongly regular graphs. For (i), the results include contributions from P S Jackson and I Sciriha, and for (ii), contributions from D Cvetković and S K Simić.