Numerical ranges and multiplier tricks

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Instead of solving the eigenvalue problem $Tf = zf$ for a linear operator T and eigenvalue z, we can use a multiplier B and instead solve the linear pencil problem $BTf = zBf$. This leads us to study the numerical range and essential numerical range of linear pencils. The essential numerical range is used to describe the set of spectral pollution when approximating the eigenvalue problem by projection and truncation methods. By taking intersection over various multipliers, we get sharp enclosures. We apply the results to various differential operators. This talk is based on joint work with Marco Marletta (Cardiff).