A symbolic-numeric method for certified eigenvalue localization

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Eigenvalues play a crucial role in nearly all areas of applied and theoretical science, with real eigenvalue locations offering critical insights for stability analysis, resonance phenomena, and physical system modeling. This work presents a hybrid approach for *certified real eigenvalue localization* for real matrices, within a computed spectrum. Our approach combines symbolic-numeric techniques: We integrate Hermite matrix certification with Gershgorin disk analysis and trace-based eigenvalue bounds. The method provides interval certifications while maintaining computational efficiency. Then we extend this approach for complex eigenvalues of complex matrices and obtain certified rectangular regions on the complex plane. We illustrate our approach on numerical examples