CORE-CHASING ALGORITHMS FOR THE EIGENVALUE PROBLEM

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Sixty years ago John Francis invented the winning general-purpose algorithm for computing eigenvalues of a matrix, the implicitly-shifted QR algorithm. This can also be applied to related problems, including the generalized eigenvalue problem. One might well think that after so many years everything that can be said about this algorithm has already been said, but this turns out not to be the case. Interesting variants and insights have been produced just in the past few years. Francis's algorithm is normally implemented as a bulge-chasing algorithm. Recently we have shown that there are some advantages to implementing it as a core-chasing algorithm instead. (Another interesting variant is the pole-swapping algorithm of Camps, Meerbergen, and Vandebril.)

This talk will focus on the core-chasing approach. We will explain what it is and show that it is particularly advantageous in certain structured cases, e.g. unitary and unitary-plus-rank-one, including the problem of computing the roots of a polynomial.

This is joint work with Jared Aurentz, Thomas Mach, Leonardo Robol, and Raf Vandebril. We have written a book [1] that summarizes our work.

References

[1] Jared L. Aurentz, Thomas Mach, Leonardo Robol, Raf Vandebril, and David S. Watkins, *Core-Chasing Algorithms for the Eigenvalue Problem*, SIAM, 2018.