Bulge Chasing is Pole Swapping

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Abstract

For at least fifty years, the dominant work-horse algorithms for solving small to medium-sized eigenvalue problems have been variants of Francis's implicitly-shifted QR algorithm, including the Moler-Stewart QZ algorithm and refinements. These are bulge-chasing algorithms. They create bulges at one end of the (Hessenberg) matrix or pencil and chase them to the other end. A few years ago a new class of algorithms, pole-swapping algorithms, was introduced by Camps, Meerbergen, Vandebril, and others. It turns out that pole swapping is a generalization of bulge chasing. It might happen that new pole-swapping codes will supplant the current QR and QZ codes in the major software packages. Whether this turns out to be true or not, the pole-swapping viewpoint is extremely valuable for a detailed understanding of what makes this class of algorithms, both bulge-chasing and pole-swapping, work. The purpose of this talk is to describe pole-swapping algorithms briefly and explain what makes them tick. Every expert in the field of eigensystem computations should be in possession of this information.