

DEPARTMENT OF MATHEMATICS AND STATISTICS  
MISSISSIPPI STATE UNIVERSITY

# COLLOQUIUM

## Tropical Scaling of Polynomial Eigenvalue Problem

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Friday, November 6, at 3:30 pm

Allen 14

**Abstract.** The eigenvalues of a matrix polynomial can be determined classically by solving a generalized eigenproblem for a linearized matrix pencil, for instance by writing the matrix polynomial in companion form. We introduce a general scaling technique, based on tropical algebra, which applies in particular to this companion form. This scaling, which is inspired by an earlier work of Akian, Bapat, and Gaubert, relies on the computation of tropical roots. We give explicit bounds, in a typical case, indicating that these roots provide accurate estimates of the order of magnitude of the different eigenvalues, and we show by experiments that this scaling improves the accuracy (measured by normwise backward error) of the computations, particularly in situations in which the data have various orders of magnitude. In the case of quadratic polynomial matrices, we recover in this way a scaling due to Fan, Lin, and Van Dooren, which coincides with the tropical scaling when the two tropical roots are equal. If not, the eigenvalues generally split in two groups, and the tropical method leads to making one specific scaling for each of the groups.

There will be a reception for Dr. Sharify in Allen 467 at 3:00.