1106-VO-913 **D. Steven Mackey** and **Vasilije Perovic*** (vasilije.perovic@wmich.edu), 1903 W. Michigan Ave, Mathematics Department, Kalamazoo, MI 49008-5248. *Linearizations of matrix polynomials in non-standard bases.* Preliminary report.

We consider nonlinear eigenvalue problems $P(\lambda)x = 0$ where $P(\lambda)$ is a matrix polynomial of the form

$$P(\lambda) = A_k\phi_k(\lambda) + A_{k-1}\phi_{k-1}(\lambda) + \cdots + A_0\phi_0(\lambda)\,, \tag{1}$$

the A_i's are $n \times n$ complex matrices, and $\{\phi_i(\lambda)\}_{i=0}^{k}$ is a non-standard basis for the space of scalar polynomials of degree at most k. Matrix polynomials as in (1) may arise either directly from applications or when solving non-polynomial eigenvalue problems via polynomial approximation.

The classical approach to the polynomial eigenproblem $P(\lambda)x = 0$ is to convert it into a larger but equivalent eigenproblem $L(\lambda)x = 0$ with $\deg L = 1$; such an L is a *linearization* for P. For this conversion it is important to avoid reformulating P into the standard basis, since this change of basis can be poorly conditioned, and may introduce numerical errors. We show how to systematically generate large new families of linearizations for P by working directly with the matrix coefficients from (1); the polynomial bases we consider include Bernstein, Newton, and Lagrange bases. (Received September 08, 2014)