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POLYNOMIAL EIGENVALUE PROBLEMS WITH HAMILTONIAN STRUCTURE*

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Abstract. We discuss the numerical solution of eigenvalue problems for matrix polynomials, where the coefficient matrices are alternating symmetric and skew symmetric or Hamiltonian and skew Hamiltonian. We discuss several applications that lead to such structures. Matrix polynomials of this type have a symmetry in the spectrum that is the same as that of Hamiltonian matrices or skew-Hamiltonian/Hamiltonian pencils. The numerical methods that we derive are designed to preserve this eigenvalue symmetry. We also discuss linearization techniques that transform the polynomial into a skew-Hamiltonian/Hamiltonian linear eigenvalue problem with a specific substructure. For this linear eigenvalue problem we discuss special factorizations that are useful in shift-and-invert Krylov subspace methods for the solution of the eigenvalue problem. We present a numerical example that demonstrates the effectiveness of our approach.

Key words. matrix polynomial, Hamiltonian matrix, skew-Hamiltonian matrix, skew-Hamiltonian/Hamiltonian pencil, matrix factorizations.

AMS subject classifications. 65F15, 15A18, 15A22.

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