

We consider solving eigenvalue problems or model reduction problems for a quadratic matrix polynomial $I\lambda^2 - A\lambda - B$ with large and sparse A and B . We propose new Arnoldi and Lanczos type processes which operate on the same space as A and B live and construct projections of A and B to produce a quadratic matrix polynomial with the coefficient matrices of much smaller size, which is used to approximate the original problem. We shall apply the new processes to solve eigenvalue problems and model reductions of a second order linear input-output system and discuss convergence properties. Our new processes are also extendable to cover a general matrix polynomial of any degree.