



## A MODIFIED NEWTON METHOD FOR A MATRIX POLYNOMIAL EQUATION ARISING IN STOCHASTIC PROBLEM\*

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**Abstract.** The Newton iteration is considered for a matrix polynomial equation which arises in stochastic problem. In this paper, it is shown that the elementwise minimal nonnegative solution of the matrix polynomial equation can be obtained using Newton's method if the equation satisfies the sufficient condition, and the convergence rate of the iteration is quadratic if the solution is simple. Moreover, it is shown that the convergence rate is at least linear if the solution is non-simple, but a modified Newton method whose iteration number is less than the pure Newton iteration number can be applied. Finally, numerical experiments are given to compare the effectiveness of the modified Newton method and the standard Newton method.

**Key words.** Matrix polynomial equation, Elementwise positive solution, Elementwise nonnegative solution,  $M$ -matrix, Newton's method, Convergence rate, Acceleration of a method.

**AMS subject classifications.** 65H10.

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