

# SOLVING QUADRATIC MATRIX EQUATIONS WITH INFINITE SIZE COEFFICIENTS

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When dealing with quadratic matrix equations  $A_{-1} + A_0X + A_1X^2 = 0$ , arising in the context of quasi-birth-death stochastic processes, one of the approaches is to rely on the Newton method; the latter is guaranteed to converge to the solution of interest in this context.

When the coefficients  $A_j$ , for  $j = -1, 0, 1$ , are infinite quasi-Toeplitz matrices, the same technique can be used. However, the computation of the Newton correction now requires the solution of Sylvester equations involving infinite matrices. We show that rational Krylov methods are applicable in this setting, with some adaptations needed to work in the infinite dimensional context. This is achieved exploiting the quasi-Toeplitz structure of the matrices under consideration. The numerical method has been implemented in the MATLAB toolbox `cqt-toolbox` [1].

## References

- [1] D. A. Bini, S. Masei, L. Robol, *Quasi-Toeplitz matrix arithmetic: a MATLAB toolbox*, Numerical Algorithms, to appear, 2019