

# MATRIX EQUATIONS IN MARKOV MODULATED BROWNIAN MOTION: THEORETICAL PROPERTIES AND NUMERICAL SOLUTION

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The stationary analysis of a Markov modulated Brownian motion [2] becomes easy once the distribution of suitable first passage times is determined. However, this distribution cannot be obtained explicitly and its computation is ultimately reduced to solving a quadratic matrix equation (QME) in [2]. In relation to this, Ahn and Ramaswami [1] derived a nonsymmetric algebraic Riccati equation (NARE) and proved that the distribution can be obtained by using the minimal nonnegative solution of the equation.

In this talk we provide an algebraic connection between the QME and the NARE. More specifically we show that the NARE can be obtained by means of a linearization of a quadratic matrix polynomial associated with the QME. As a consequence, we explicitly relate the solutions of the QME with the solutions of the NARE. To conclude, we discuss some algorithms and accelerating techniques for computing the minimal nonnegative solution of the NARE.

## References

- [1] S. Ahn and V. Ramaswami. A quadratically convergent algorithm for first passage time distributions in the Markov modulated Brownian motion. *Stochastic Models*, 33(1):59–96, 2017.
- [2] S. Asmussen. Stationary distributions for fluid flow models with or without Brownian noise. *Stochastic Models*, 11:1–20, 1995.