ON THE SOLUTION OF THE NONSYMMETRIC T-RICCATI EQUATION

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We consider the nonsymmetric T-Riccati equation

$$0 = \mathcal{R}_T(X) := DX + X^T A - X^T B X + C, \tag{1}$$

where $A, B, C, D \in \mathbb{R}^{n\times n}$ and sufficient conditions for the existence and uniqueness of a minimal (w.r.t. entry-wise comparison) solution $X_{\min} \in \mathbb{R}^{n\times n}$ are provided. To date, the nonlinear matrix equation (1) is still an unexplored problem in numerical analysis and both theoretical results and computational methods are lacking in the literature. We provide some sufficient conditions for the existence and uniqueness of a nonnegative minimal solution and discuss its efficient computation. Both the small-scale and the large-scale settings are addressed and Newton-Kleinman-like methods are derived. The convergence of these procedures to the minimal solution is proved and several numerical results illustrate the computational efficiency of the proposed methods.