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CORRESPONDENCE

Response to comments on "Computing the Positive Stabilizing Solution to Algebraic Riccati Equations with an Indefinite Quadratic Term via a Recursive Method"

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In our paper [1], we propose an iterative algorithm to solve AREs with an indefinite quadratic term, analyse its convergence, and demonstrate the effectiveness of our algorithm via five examples. For Example 3, we deliberately proposed a problem where standard methods would not work to illustrate the numerical reliability of our algorithm. We indeed noted that this example was chosen as one where "traditional methods fail", which of course does not contradict the possibility of it being addressed in another manner as well as ours. The authors of the comment [2] have shown that it can also be solved with a scaling method followed by a Schur decomposition as proposed in their references. This may be helpful to some readers, and we thank them for pointing it out.

Our algorithm provides a unified way of dealing with a large class of problems (i.e. solving H_∞-type AREs), including all five numerical examples that we presented in [1], some of which can be handled with other methods (for example the scaled Schur method in the comment) as well. In general, although scaling is a well-known approach which may help to solve eigenvalue problems accurately, it may also has some negative effects on accuracy. This is why, even in standard eigenvalue software (LAPACK), scaling is not automatically performed when computing eigenvectors and is just an option of the user. Moreover, it is not always straightforward to find the right scaling. Furthermore, applying the scaling method of the authors does require computing the stable invariant subspace of Hamiltonian (thus practically solving the Riccati equation). This is a critical computation involving separation of stable and unstable eigenvalues, and if this computation fails (due to ill-conditioning of the eigenvalue problem), then the proposed scaling is not applicable. On the other hand, our algorithm can compute highly accurate solutions without scaling, which is a very desirable feature of any algorithm.

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References

[1] Lanzon, A., Feng, Y., Anderson, B.D.O. and Rotkowitz, M. Computing the Positive Stabilizing Solution to Algebraic Riccati Equations with an Indefinite Quadratic Term via a Recursive Method. IEEE Trans. Automat. Contr., V.53, N.10, November 2008, pp. 2280-2291.

[2] Aliev, F. A. and Larin, V. B. Comments on "Computing the Positive Stabilizing Solution to Algebraic Riccati Equations with an Indefinite Quadratic Term via a Recursive Method", Appl. and Comput. Math., V.8, N.2, 2009, pp.268-269.

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