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Recent Progresses on Highly Entrywise Accurate Methods For Matrix Equations

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In 2002, Alfa, Xue, and Ye showed that the inverse of a nonsingular M-matrix can be determined to highly relative entrywise accuracy by a triplet representation of the M-matrix, and devised the so-called GTH-like algorithm, a variant of Gaussian elimination, to deliver a numerical inverse with comparable entrywise relative accuracy. The breakthrough form the foundation of later developments in numerical solutions of the M-matrix algebraic Riccati equation (MARE) and the Quasi-Birth-and-Death (QBD) equation with guaranteed high relative entrywise accuracy. In this talk, we will survey those developments, including recent ones on the shifted M-matrix algebraic Riccati equation and the structured M-matrix algebraic Riccati equation.

References

[1] A. S. Alfa, J. Xue, and Q. Ye. Accurate computation of the smallest eigenvalue of a diagonally dominant M-matrix. *Math. Comp.*, 71:217–236, 2002.

[2] A. S. Alfa, J. Xue, and Q. Ye. Entrywise perturbation theory for diagonally dominant M-matrices with applications. *Numer. Math.*, 90(3):401–414, 2002.

[3] Guiding Gu, Li Wang, and Ren-Cang Li. Highly accurate latouche-ramaswami logarithmic reduction algorithm for Quasi-Birth-and-Death process. *J. Math. Study*, 2022. to appear.

[4] Changli Liu, Wei-Guo Wang, Jungong Xue, and Ren-Cang Li. Accurate numerical solution for structured M-matrix algebraic Riccati equations. *J. Comput. Appl. Math.*, 396(113614), 2021.

[5] Changli Liu, Jungong Xue, and Ren-Cang Li. Accurate numerical solution for shifted M-matrix algebraic Riccati equations. *J. Sci. Comput.*, 84(15), 2020.

[6] G. T. Nguyen and F. Poloni. Componentwise accurate fluid queue computations using doubling algorithms. *Numer. Math.*, 130(4):763–792, 2015.

[7] Jungong Xue and Ren-Cang Li. Highly accurate doubling algorithms for M-matrix algebraic Riccati equations. *Numer. Math.*, 135(3):733–767, 2017.

[8] Qiang Ye. On Latouche-Ramaswami's logarithmic reduction algorithm for quasi-birth-and-death processes. *Stoch. Models*, 18:449–467, 2002.