Dear Prof.:

I hope everything goes well with you. I am very happy to have the chance of submitting my recent work entitled as “A generalization of RSHSS iteration methods for two-sided unsteady spatial-fractional diffusion equations ” to your highly esteemed journal. I confirm that this paper is original, neither partly nor wholly has been published anywhere in any forms, this paper is not under review  by another journal, and I will not re-submit it to another journal or a conference during the reviewing procedure.

For the spatial fractional diffusion equations with two-sided unsteady variable coefficients, it can be discretized by the implicit finite difference method derived from the shifted Grünwald scheme. The coefficient matrix of the discrete linear system is in the form of the sum of an identity matrix and two diagonal multiplied Toepliz matrices. This paper constructs a generation of RHSSS iteration methods, gives its asymptotic convergence conditions, and replaces the Toeplitz matrices with circulant matrices to establish a more practical and efficient FGRSHSS preconditioner to improve the convergence rate of the generalized minimum residual (GMRES) iteration method.The theoretical proof gives an accurate analysis of the eigenvalues distribution of FGRSHSS preconditioned matrix.Finally, the numerical simulation experiments give the figures of the eigenvalues distribution of the FGRSHSS preconditioned matrix, and verify the feasibility and efficiency of the FGRSHSS preconditioner.

Please acknowledge the receipt of my submission at your convenient time.

Looking forward to hearing from you sooner.

With Best Regards

 Sincerely Yours

Xin-Hui Shao