

**The Hong Kong Polytechnic University  
Department of Applied Mathematics**

**Colloquium**

**Wavelet-based Edge Multiscale Parareal Algorithm for subdiffusion equations with heterogeneous coefficients in a large time domain**

**By**

**Prof. Guanglian LI**

**The University of Hong Kong**

**Abstract**

I will present in this talk the Wavelet-based Edge Multiscale Parareal (WEMP) Algorithm recently proposed in [Li and Hu, J. Comput. Phys., 2021] to efficiently solve subdiffusion equations with heterogeneous coefficients in long time. This algorithm combines the advantages of multiscale methods that can effectively deal with heterogeneity in the spatial domain, and the strength of parareal algorithms for speeding up time evolution problems when sufficient processors are available. Compared with the previous work for parabolic problem, the main challenge in both the analysis and simulation arises from the nonlocality of the fractional derivative. To conquer this obstacle, an auxiliary problem is constructed on each coarse temporal subdomain to uncouple the temporal variable completely. In this manner, the approximation properties of the correction operator is proved. In addition, a new summation of exponential sums is derived to generate single-step time stepping scheme, with the number of terms of  $\mathcal{O}(|\log \tau_f|)$  independent of final time. Here,  $\tau_f$  is the fine-scale time step size. We derive the convergence rate of this algorithm in terms of the mesh size in the spatial domain, the level parameter used in the multiscale method, the coarse-scale time step size and the fine-scale time step size. Several numerical tests are presented to demonstrate the performance of our algorithm, which verify our theoretical results perfectly.



**Date: 28 October 2021 (Thursday)**

**Time: 15:00-16:00 (Hong Kong Standard Time GMT +8)**

**Venue: Online Talk via Zoom (Meeting ID: 948 2763 9673)**

**Speaker: Prof. Guanglian Li, The University of Hong Kong**

**Host: Dr. Zhi Zhou, The Hong Kong Polytechnic University**

**Click to join:**

<https://polyu.zoom.us/j/94827639673?pwd=WGpkcDM1S1QxaWUyZDlaM1MxVHRBQT09>

[Click to join \(Zoom\)](#)

**\*\*\* ALL ARE WELCOME \*\*\***

For enrolment, please send your name and email to [wai-yan.moon@polyu.edu.hk](mailto:wai-yan.moon@polyu.edu.hk) on or before 27 October 2021