# Improved patch dynamics technique in equation-free multiscale modelling

T.K. Karmakar & D.C. Dalal∗

# Abstract

Patch dynamics scheme of ‘equation-free multiscale modelling’ is one of the techniques which aims to extract the macroscopic information using the known microscopic model simulation in patches (which is a fraction of the space-time domain) that reduces the computational complexity. The main challenge of multiscale modelling is to develop bridging between different scales to transform and transfer information. In this study, an improved patch dynamics (IPD) scheme is proposed by distributing the gap-tooth timesteppers within each long macroscopic time step ∆*t*. This distribution can be done in two ways, which are named as IPD of type-I and type-II. The gap-tooth timesteppers are distributed in this way because it decreases the extrapolation time, thus improving the solution. In addition, one can choose either a uniform or non-uniform distribution of gap-tooth timesteppers, as well as the extrapolation times according to the physics of the problem. Compared to patch dynamics scheme, IPDs of both types are capable of providing better accuracy with less computation time. Real-life problems are more appropriately addressed by IPD. In cases where the UPD scheme fails to converge for a long extrapolation time, both types of IPD can be applied. The whole method has been applied successfully in the one-dimensional diffusion problem.

1