APCOM & ISCM
11-14th December, 2013, Singapore

Development of Multiscale Thrombosis Simulator on Massively Parallel Computer

***Kazuyasu Sugiyama[1], Satoshi Ii[2], Shu Takagi[3], and Yoichiro Matsumoto[3]**

[1]Advanced Center for Computing and Communication, RIKEN, 2-1 Hirosawa, Wako-shi, Saitama, Japan
[2]Graduate School of Engineering Science, Osaka University, 1-3 Machikaneyama, Toyonaka-shi, Osaka, Japan
[3]School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan

*Corresponding author: kazuyasu.sugiyama@riken.jp

We have developed a multiscale simulator for a primary stage of thrombus formation as a result of a platelet adhesion on an injured vessel wall. To capture continuum scale blood flows including a large number of red blood cells (RBCs) and platelets, the simulator numerically solves fluid-membrane interaction problems. It also treats a molecular scale ligand-receptor interaction between the von Willebrand factor on the injured vessel wall and the Glycoprotein Ibα on the platelet by means of the stochastic Monte-Carlo method. Large scale simulations are performed using the K computer, which achieved the sustained performance beyond 10 Pflops for the LINPACK benchmark. We discuss the role of the RBC, which aggitates the surrounding fluid flow and causes the platelet fluctuation, on the level of the thrombus formation.

Keywords: Blood Flow, Fluid-Membrane Interaction, Ligand-Receptor Interaction, Thrombus, Parallel Computing