Navier-stokes equation:

$$\rho\frac{\partial u}{\partial t} = -\nabla P + \nabla.(\mu(\nabla u + \nabla u^T)) \tag{1}$$

$$\mu = \lambda\left|\dot{\gamma}\right|^{n-1} \tag{2}$$

shear rate is given as

$$\dot{\gamma} = \frac{1}{2}\left[\nabla u + (\nabla u)^T\right] \tag{3}$$

The area encompassing the ladder wall surface is represented as Θ and the velocity of particle i at time t is given as:

$$v_p(i,t) = v_p(i,t-1) + \frac{F_d(i,t)}{m_p} \;\; \forall \;\; i \;\; \notin \;\; \Theta \tag{4}$$

$$v_p(i,t) = 0 \;\; \forall \;\; i \;\; \in \;\; \Theta \tag{5}$$

Drag force on particle i at time t is given as:

$$F_d(i,t) = \frac{18\mu}{\rho_p d_p^2} m_p\left[v_p(i,t) - u(x,y,t)\right] \tag{6}$$

Assumptions: *(i)* Particle interactions with the wall were assumed to result in zero velocity as shown in Eqn. 5, *(ii)* Particle-particle interactions were not modeled, *(iii)* Flow induced thrombus is modeled as discrete evolution with sequential changes in geometry as shown below.

Flow induced thrombus formation algorithm:

The over all microfluidic ladder network area($\bar{\Xi}$) is segmented into several squares of a side equal to $10um$. Shear rate ($\dot{\gamma}$), platelet number (ni_p), thrombin concentration ($\dot{Th}$) are calculated in this segmented regions to predict thrombus nucleation and growth in the following steps.

Step 1: Predict the area of maximum shear rate ($\bar{\Theta}$) in the ladder device

$$\bar{\Theta} = \max\left\{\dot{\gamma}(\Xi)\right\} \;\; \forall \;\; \Xi \in \bar{\Xi} \tag{7}$$

Step 2: Predict the region with maximum number of platelet particles (Γ)

$$\Gamma = \max\left\{n_p(\Xi)\right\} \;\; \forall \;\; \Xi \in \bar{\Xi} \tag{8}$$

Step 3: Prediction of high probability thrombus nucleation area (Π) in the ladder network

$$\Pi = \bar{\Theta} \cap \Gamma \tag{9}$$

Step 4: Based on the nucleation sites the geometry is modified with clots of 5% occlusion and these clots act as source of thrombin generation. The maximum thrombin concentration ($\dot{Th}$) in the ladder network is given as follows:

$$\dot{Th} = \max\left\{C_i(\Xi)\right\} \;\; \forall \;\; \Xi \in \bar{\Xi} \tag{10}$$

Step 5: Prediction of thrombus growth and propagation regions in ladder network ($\bar{\Pi}$)

$$\bar{\Pi} = (\bar{\Theta} \cap \Gamma) \cap \dot{Th} \tag{11}$$