

Figure 1: Summary of the model for (A) single biofilm streamer, (B) side-by-side biofilm streamers and (C) in-line biofilm streamers.

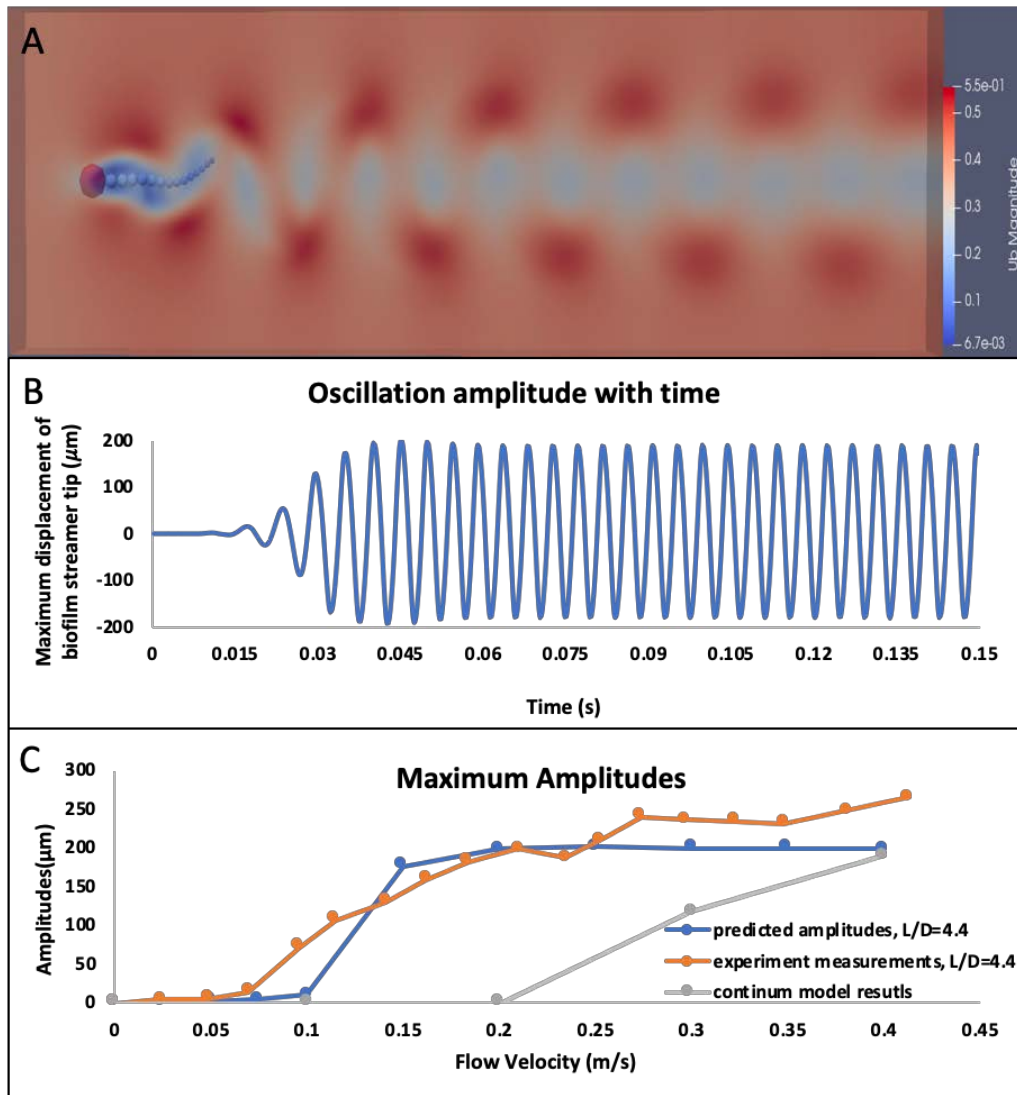


Figure 2: (A) Streamer oscillation and velocity field. (B) The temporal vibration amplitudes of inline biofilm steamers tip at flow velocity of 0.4m/s. (C) Maximum amplitudes of biofilm steamer tip determined by the present study and experiments results [8] as well as numerical simulations reproduced in (Stoodley et al., 1998; Taherzadeh et al., 2010).

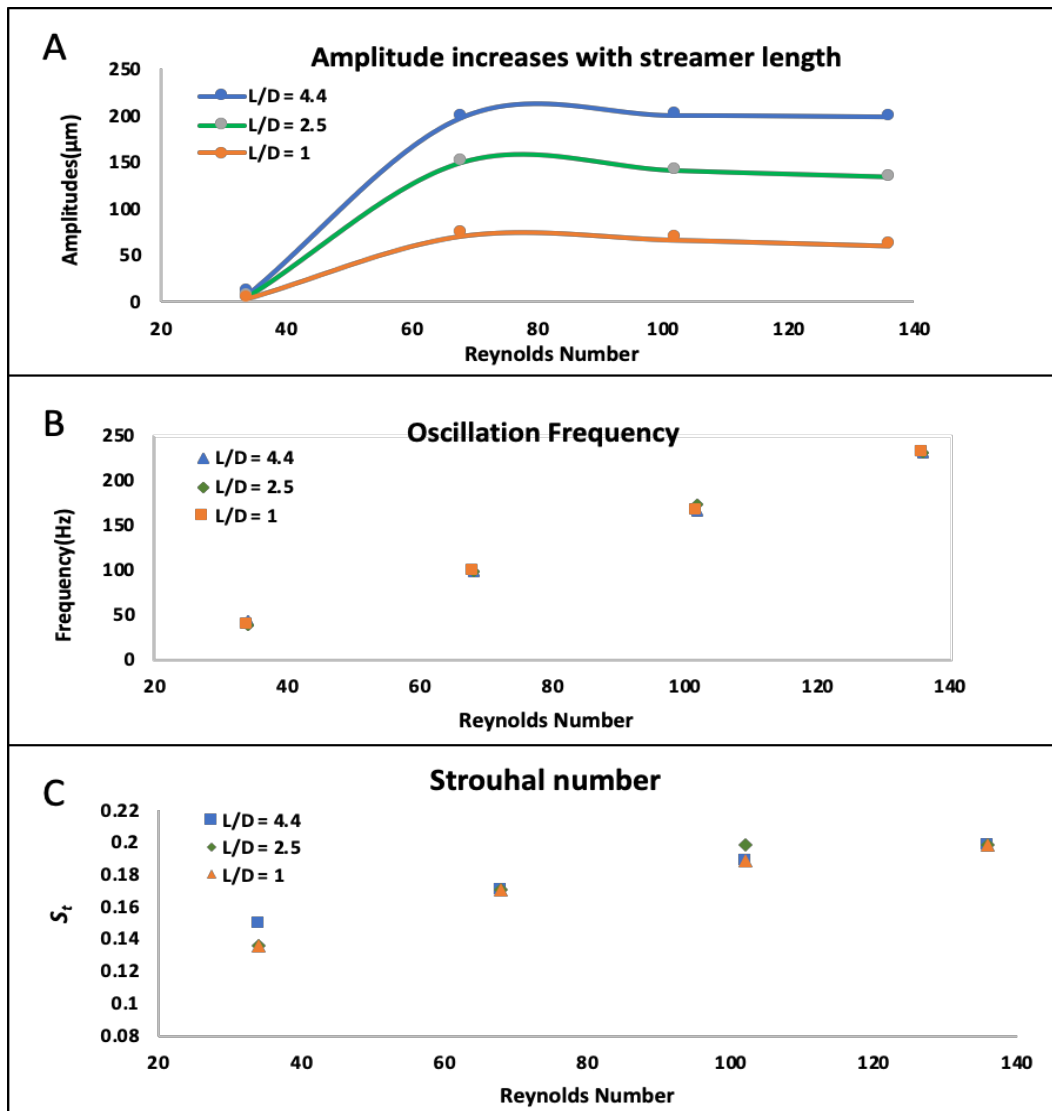


Figure 3: The (A) oscillation amplitudes, (B) frequency of streamer of different length and (C) Strouhal number vs Reynolds number for fluid velocity ranging from 0.1 to 0.4m/s.

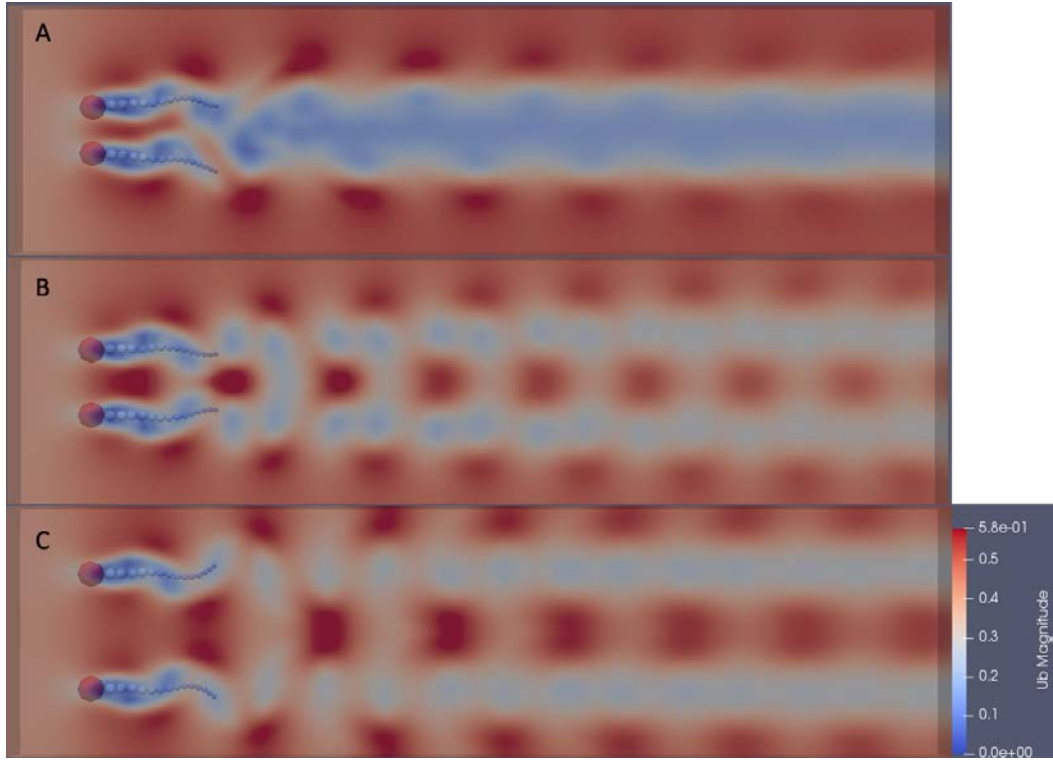


Figure 4: The oscillation and flow field of two side-by-side biofilm streamers with (A) $l/L = 0.4$, (B) 0.56 and (C) 1 at $v=0.4\text{m/s}$ and $t=0.1\text{s}$.

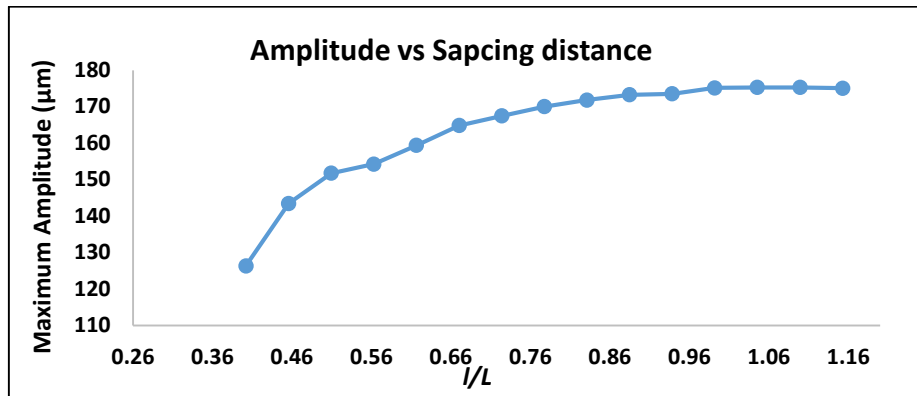


Figure 5. Maximum oscillation amplitude of side-by-side biofilm streamers varying spacing distance l/L from 0.4 to 1.13, $v=0.4\text{m/s}$.

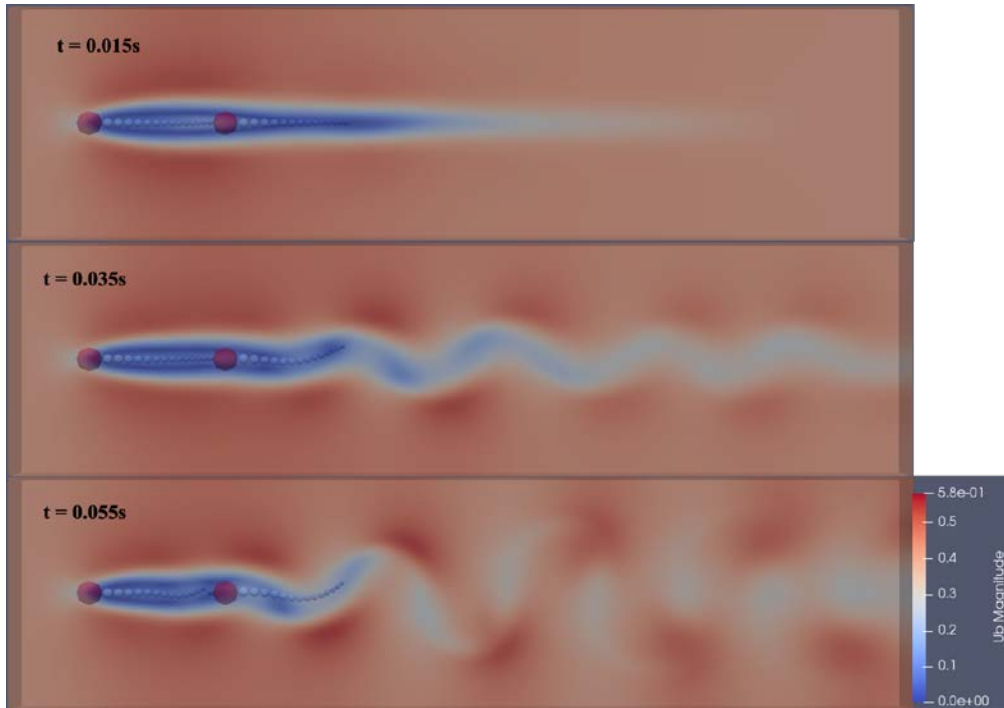


Figure 6: Temporal vibration for in-line streamers with $h/L = 0$, at flow velocity of $0.4m/s$.

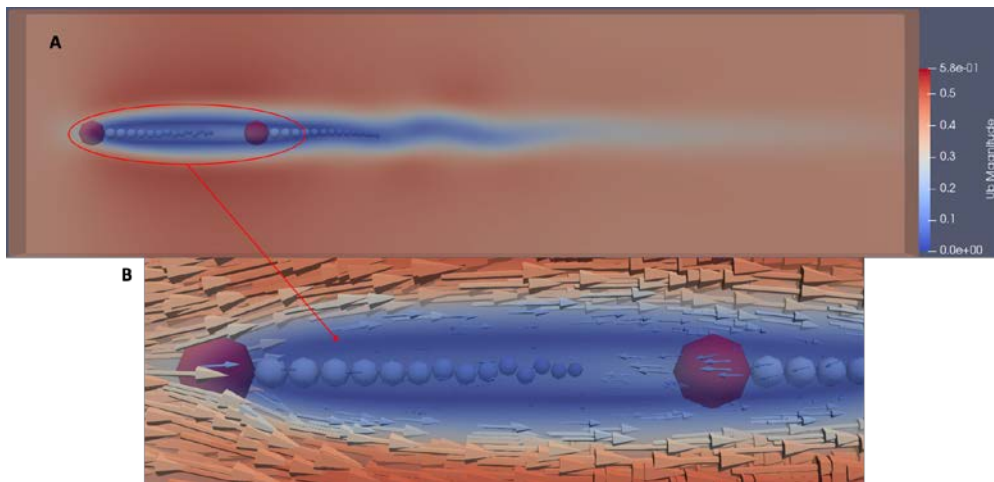


Figure 7. The behaviours of inline biofilm streamers ($h/L = 0.25$) at $v=0.4m/s$ and $t=0.08s$.

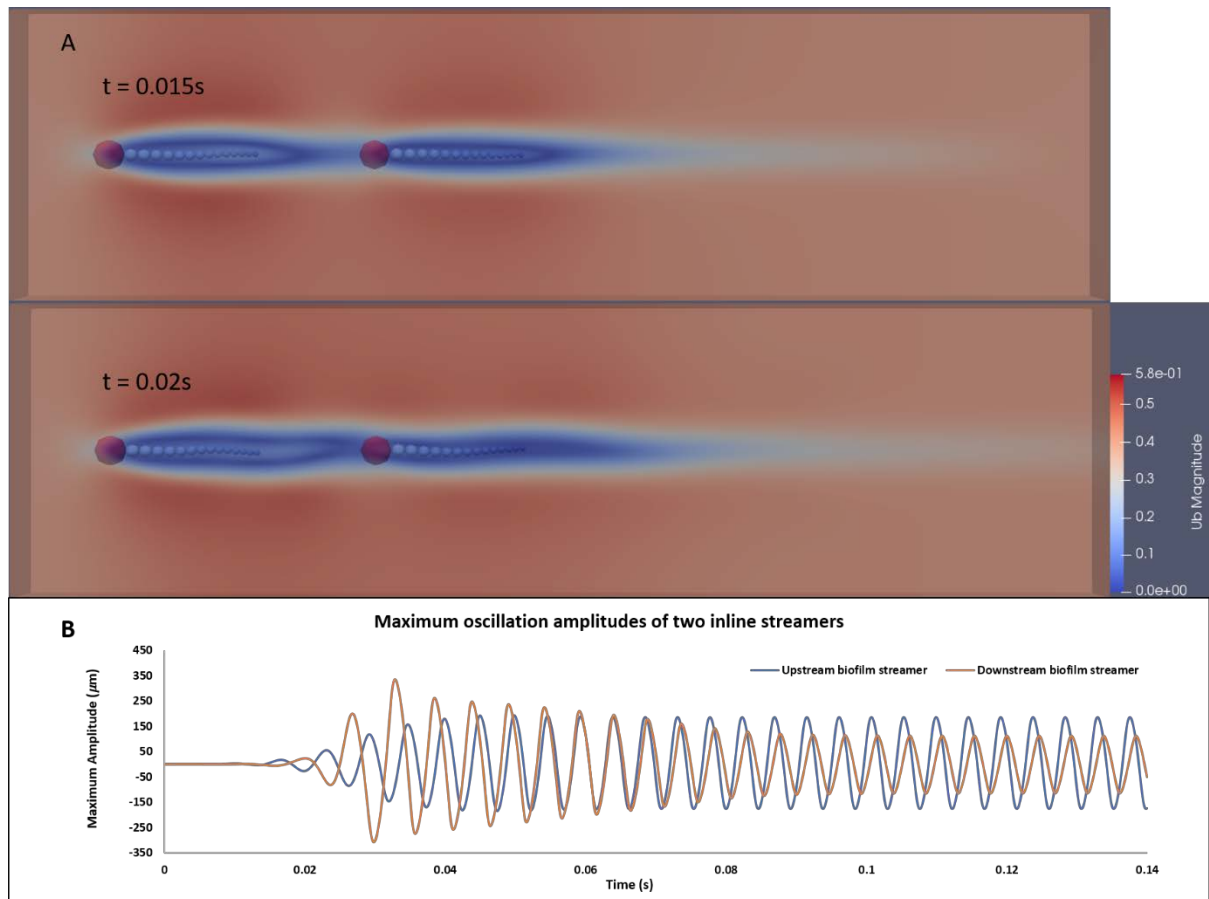


Figure 8. (A) The flow pattern and oscillation of inline biofilm streamers ($h/L = 0.75$) at flow velocity of $0.4m/s$ at $0.015s$ and $0.02s$. (B) The temporal vibration amplitudes of inline biofilm steamers tip at flow velocity of $0.4m/s$.

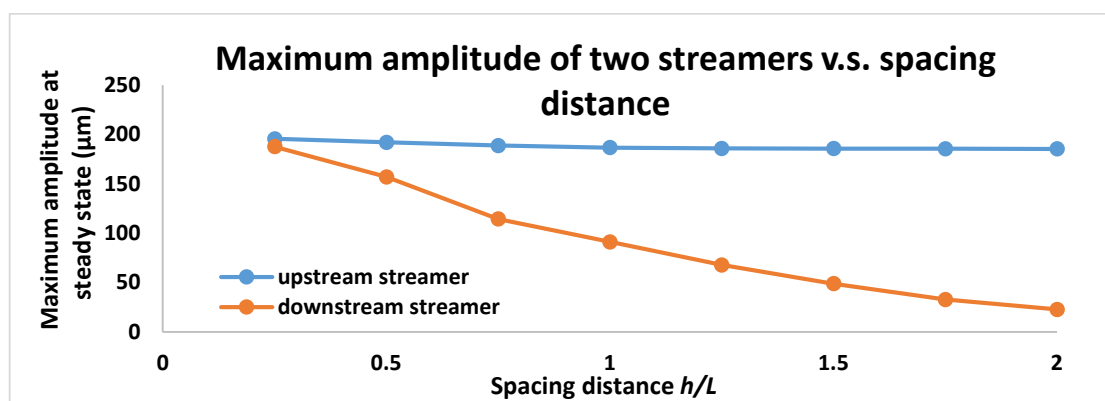


Figure 9. Maximum oscillation amplitude of inline biofilm streamers with different spacing distance (h/L) at flow velocity of $0.4m/s$.