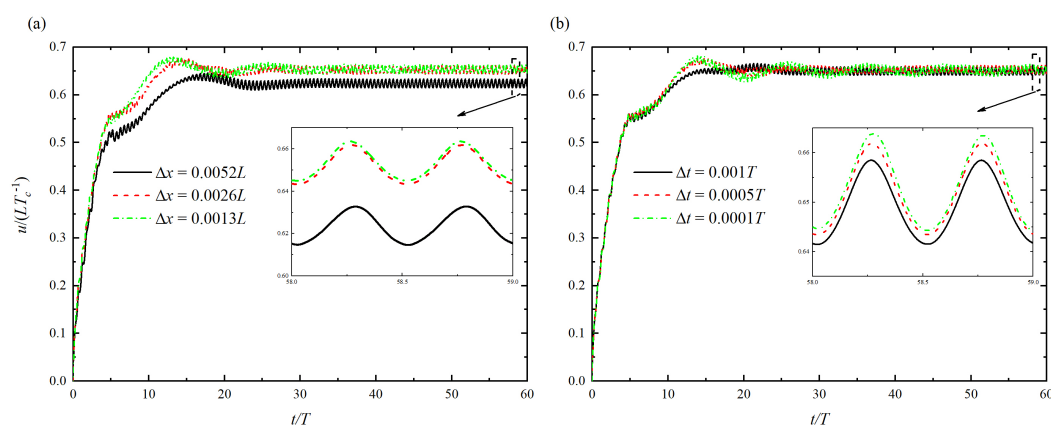


## Supplementary Materials:

In the current simulations, the computational domain is discretized with a four-level hierarchy of Cartesian grids by using an adaptively refined grid. It is noted that two fish are always embedded in the finest grid. The independence tests of mesh and time step are conducted for the two fish swimming in a tandem arrangement, and the specific swimming parameters are set as:  $d_0=0.5L$ ,  $A=0.1L$ ,  $f=1$ ,  $\lambda=1L$  and  $\delta\phi=0$ . First, the mesh independence test is done for three sets of meshes with sizes of  $\Delta x=0.0052L$ ,  $0.0026L$  and  $0.0013L$  at the time step of  $\Delta t=0.0005T$ . The time histories of swimming speed  $u$  of the rear fish are presented in Figure S1a, and the values of steady swimming speed  $\bar{u}$  are provided in Table S1. The difference of  $\bar{u}$  between  $\Delta x=0.0026L$  and  $0.0013L$  is reasonably small (0.2543%). Thus, the mesh size of  $\Delta x=0.0026L$  is selected in the following simulations. Then, three time steps of  $\Delta t=0.001T$ ,  $0.0005T$  and  $0.0001T$  are used for time step independence test at  $\Delta x=0.0026L$ . The time histories of swimming speed  $u$  of the rear fish are presented in Figure S1b, and the corresponding values of  $\bar{u}$  are listed in Table S2. The difference of  $\bar{u}$  between  $\Delta t=0.0005T$  and  $0.0001T$  is only 0.1226%. So  $\Delta t=0.0005T$  is selected in the following simulations.



**Figure S1.** Time histories of the swimming speed from (a) different mesh sizes with  $\Delta t=0.0005T$  and (b) different time steps with  $\Delta x=0.0026L$ .

**Table S1.** Mesh independence test results with  $\Delta t=0.0005T$ .

$\Delta x$	$\bar{u}/(LT_c^{-1})$	$\Delta\bar{u}(\%)$
0.0052L	0.6234	4.3582
0.0026L	0.6518	0.2543
0.0013L	0.6534	—

**Table S2.** Time-step independent test results with  $\Delta x=0.0026L$ .

$\Delta t$	$\bar{u}/(LT_c^{-1})$	$\Delta\bar{u}(\%)$
0.001T	0.6493	0.3817
0.0005T	0.6518	0.1226
0.0001T	0.6526	—