Numerical Validations of the CLSVOF Model

Yan Zhan

July 18th 2014

Outline

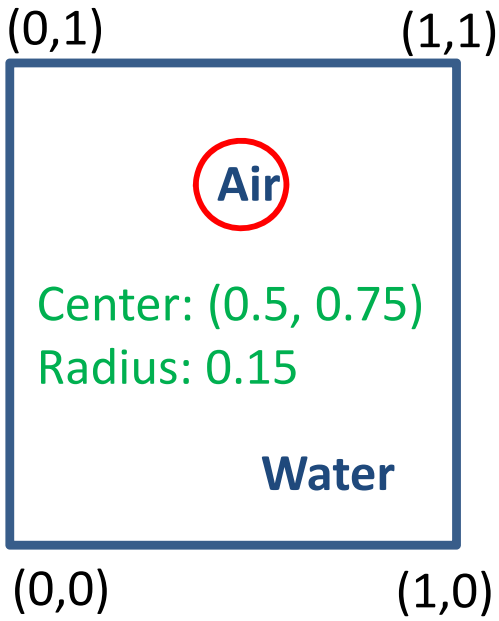
- Droplet movement due to a constant velocity field

  (u=1 m/s,v=0 m/s), (u=0,v=-1 m/s),(u=1 m/s,v=-1 m/s)

- Droplet deformation due to a vortex velocity field

  $\Psi = sin^2(\pi x)sin^2(\pi y)\cos(\pi t/T)/\pi$ = stream function

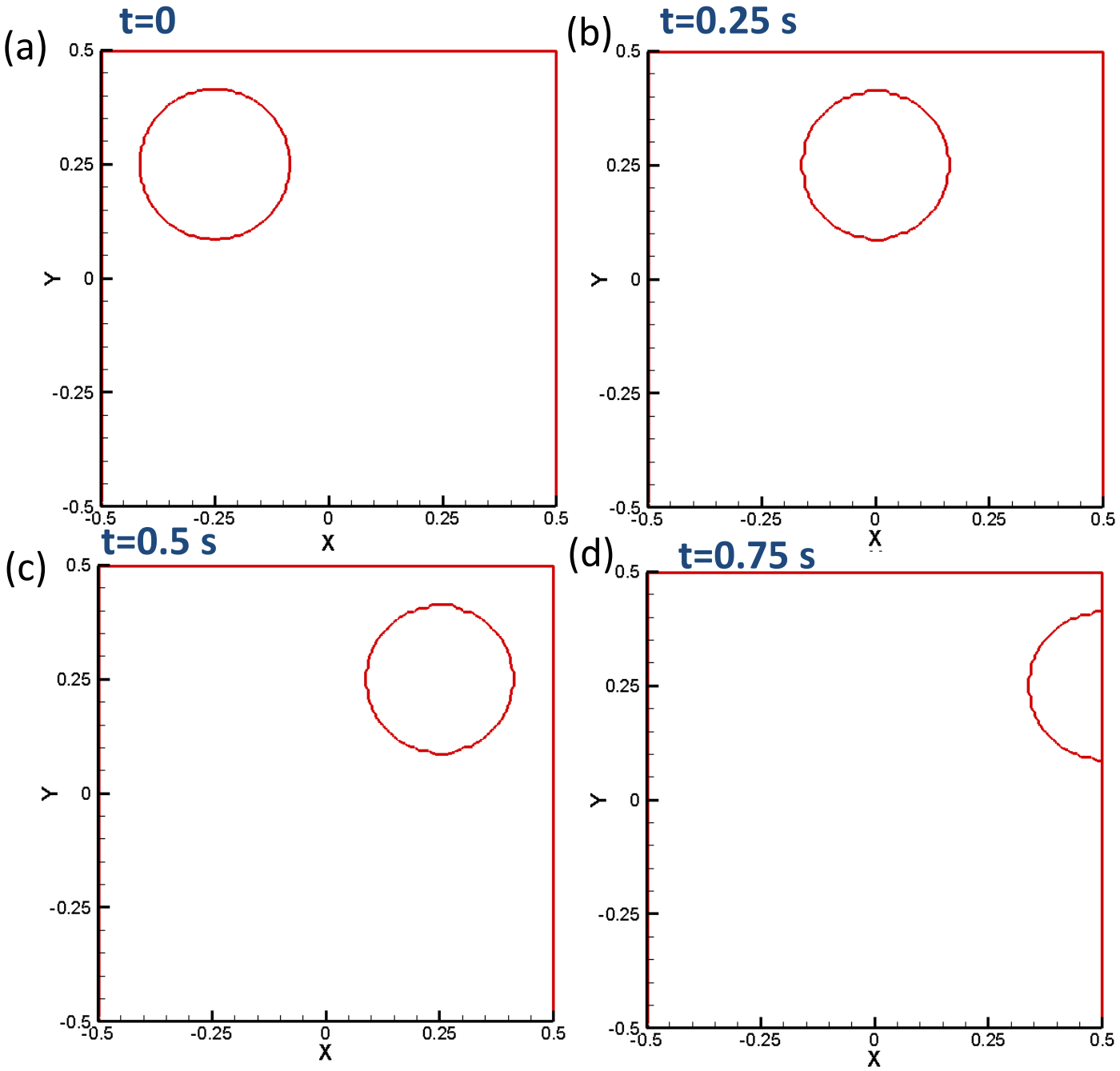
T (sec)	Mesh Grids	Method
2	128*128 256*256 512*512	Developed CLSVOF Method
6	128*128 256*256 512*512	Developed CLSVOF Method FLUENT CLSVOF Method Nichita's Simulation*
12	128*128 256*256 512*512	Developed CLSVOF Method



* B.A. Nichita, An Improved CFD Tool to Simulate Adiabatic and Diabatic Two-Phase Flows, EPFL 2010
http://puhep1.princeton.edu/~mcdonald/examples/fluids/nichita_thesis_10.pdf

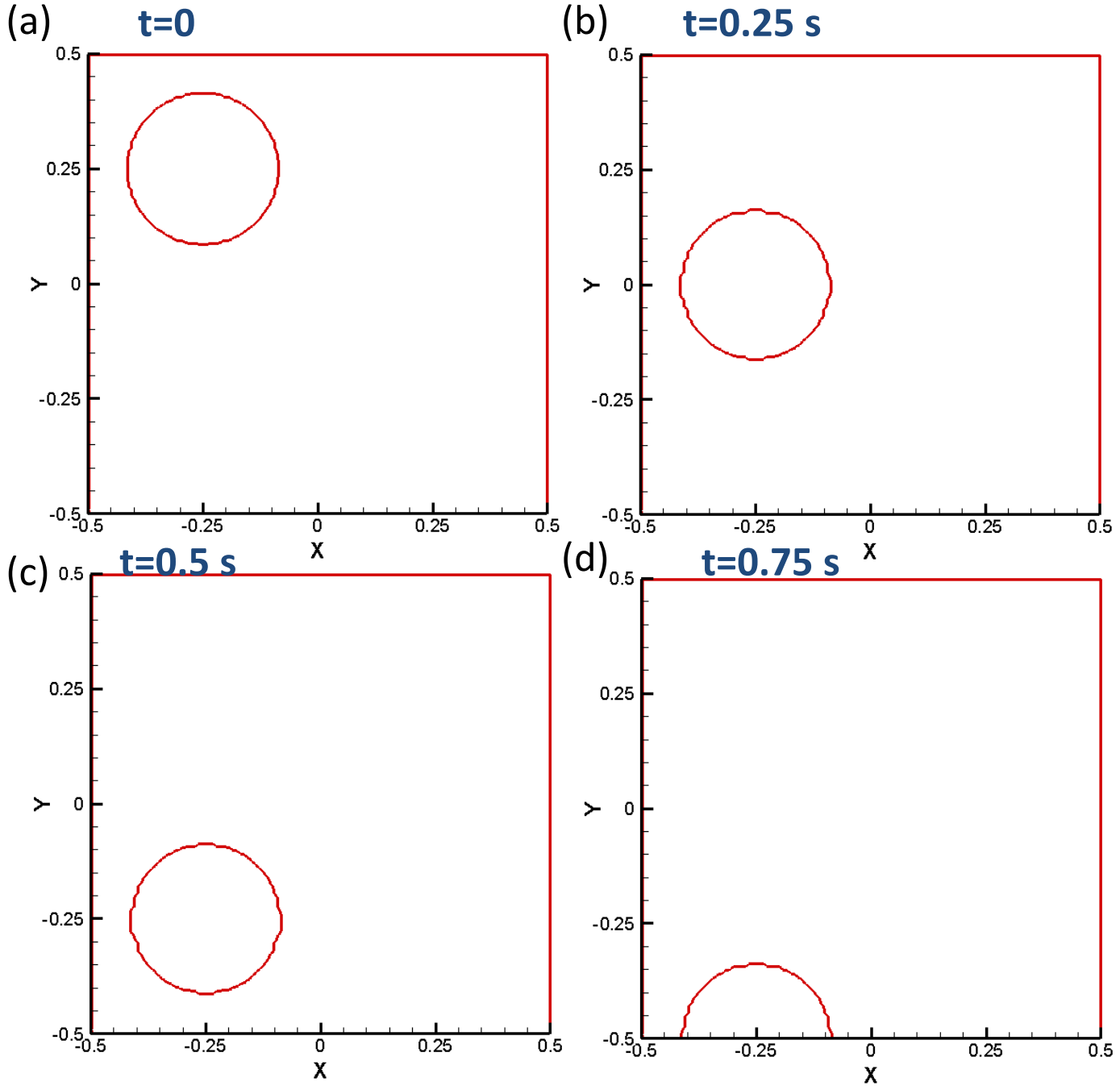
? "Droplet" may be just an imaginary surface in a single fluid ? (KTM)

Droplet movement due to a constant velocity field — u = 1 m/s, v = 0 m/s



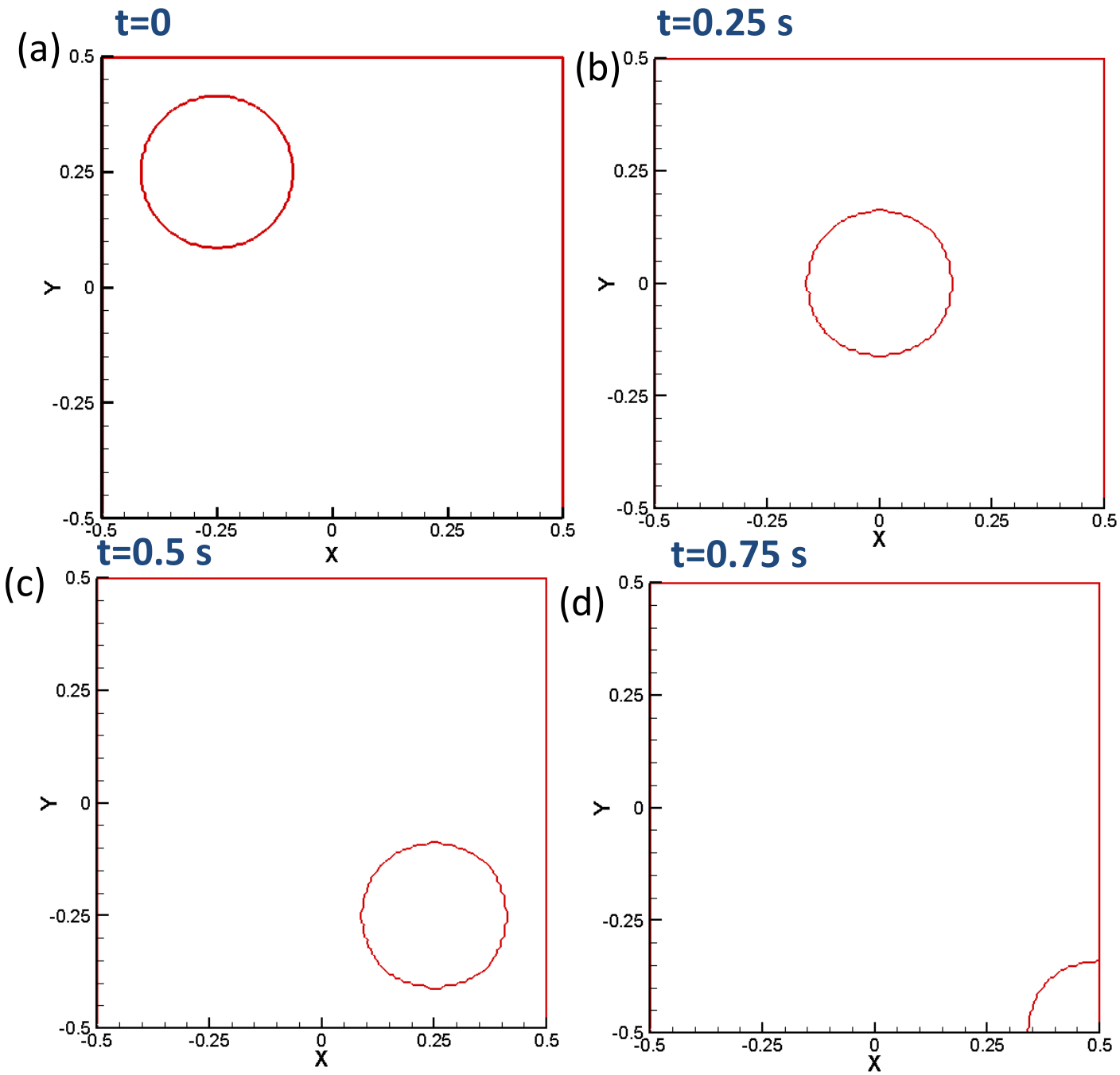
Units for x and y: m

Droplet movement due to a constant velocity field — u = 1 m/s, v = 0 m/s



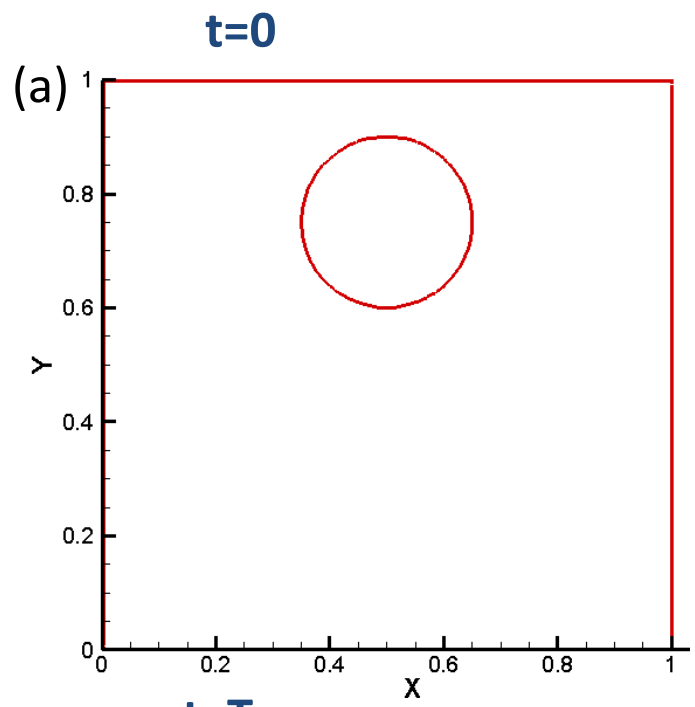
Units for x and y: m

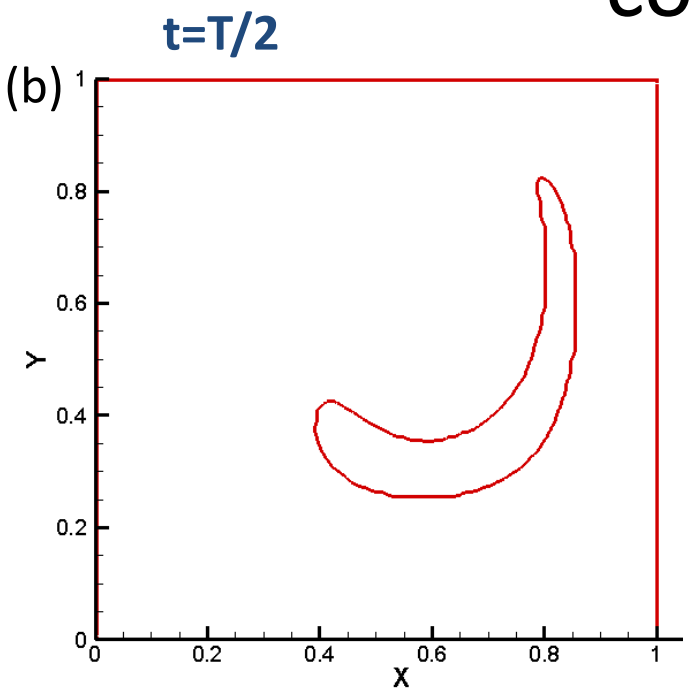
Droplet movement due to a vortex velocity field — u = 1 m/s, v = 0 m/s



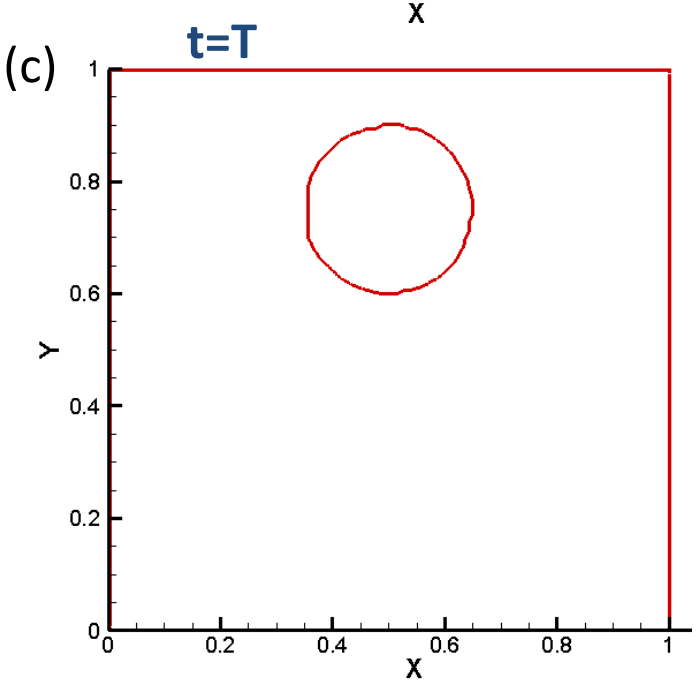
Units for x and y: m

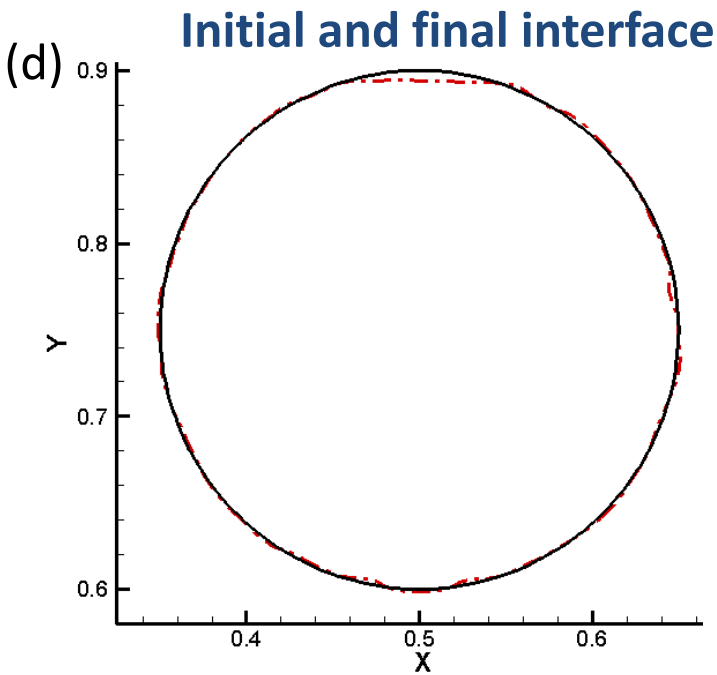
Droplet movement due to a vortex velocity field — coarse_T=2 s



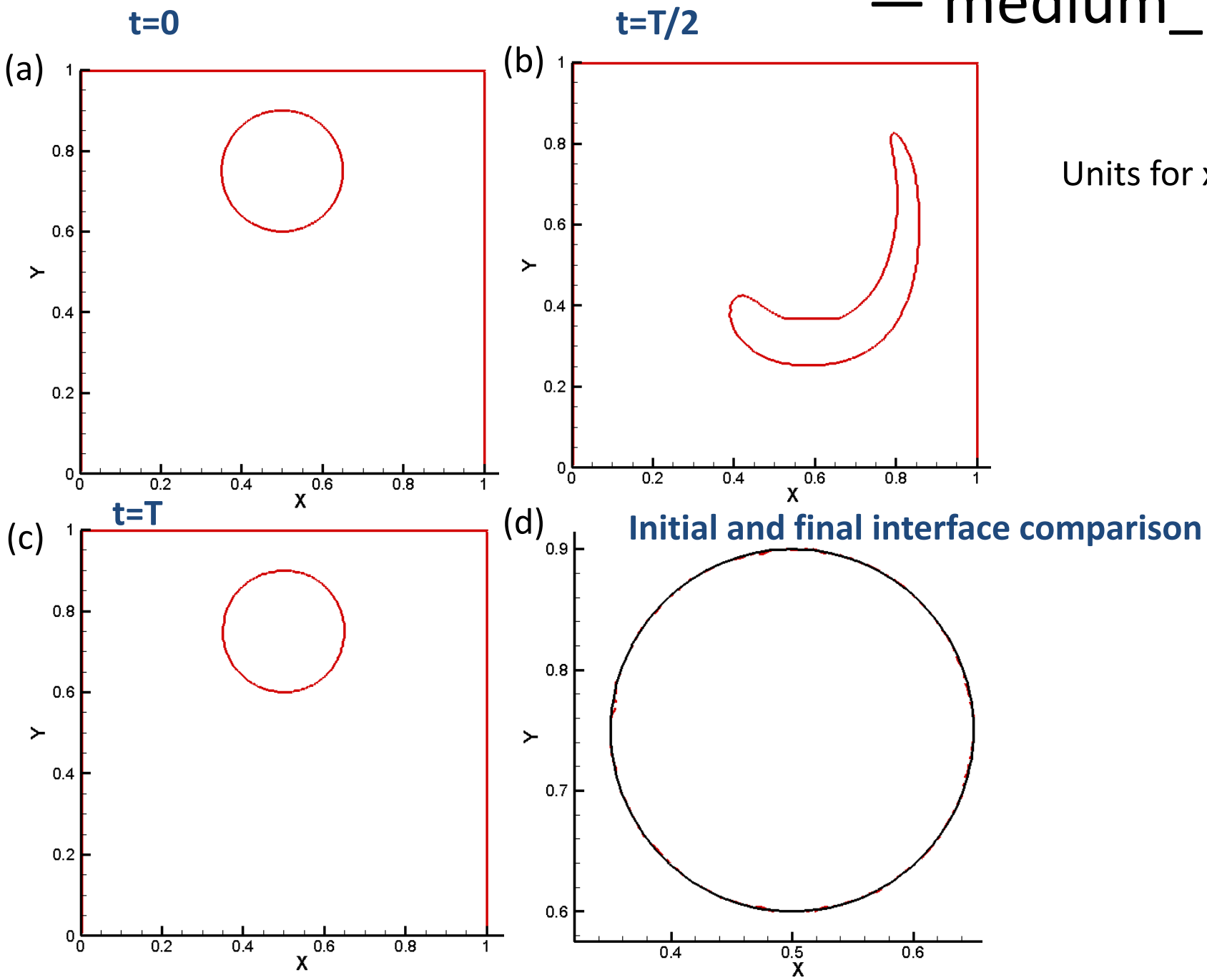


Units for x and y: m



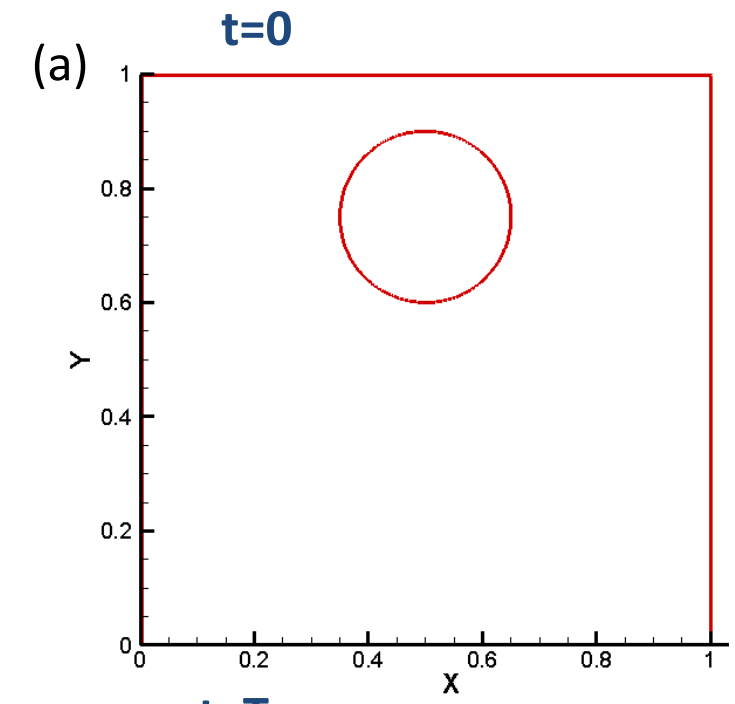


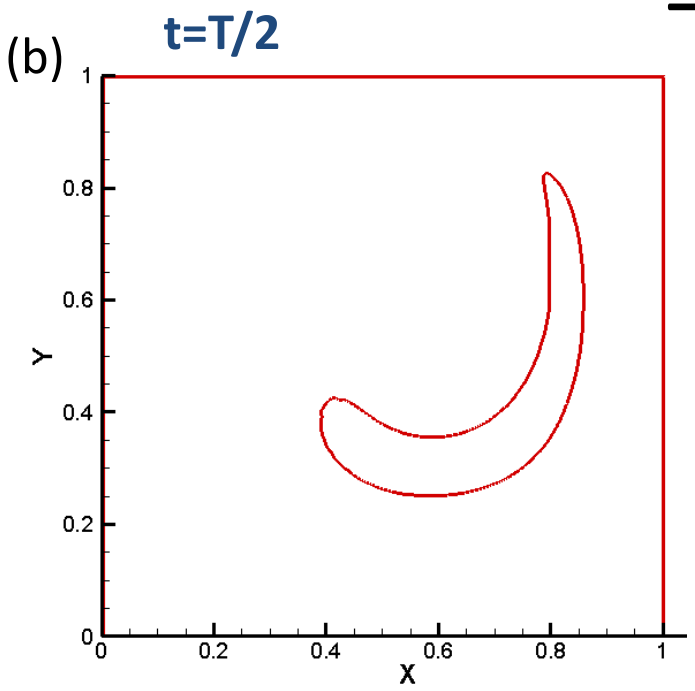
Droplet movement due to a vortex velocity field — medium_T=2 s



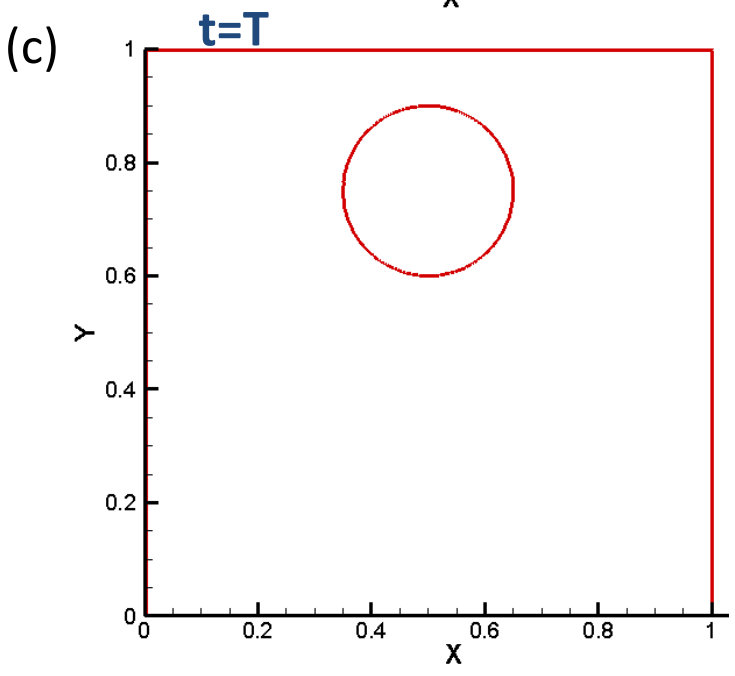
Units for x and y: m

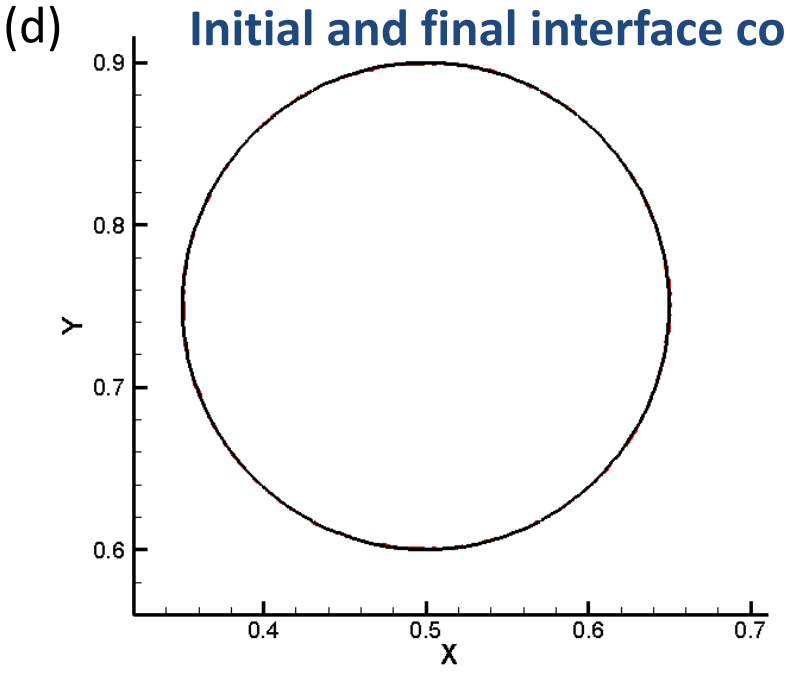
Droplet movement due to a vortex velocity field — fine_T=2 s



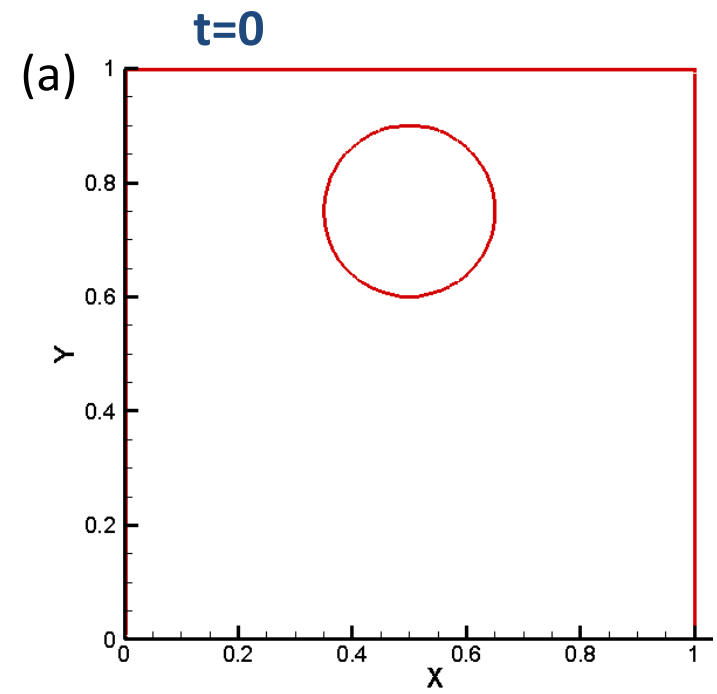


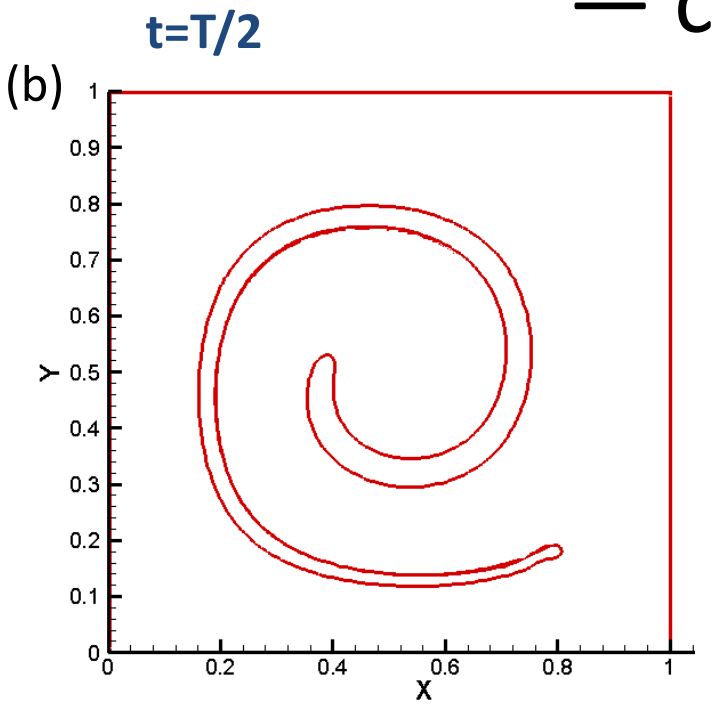
Units for x and y: m



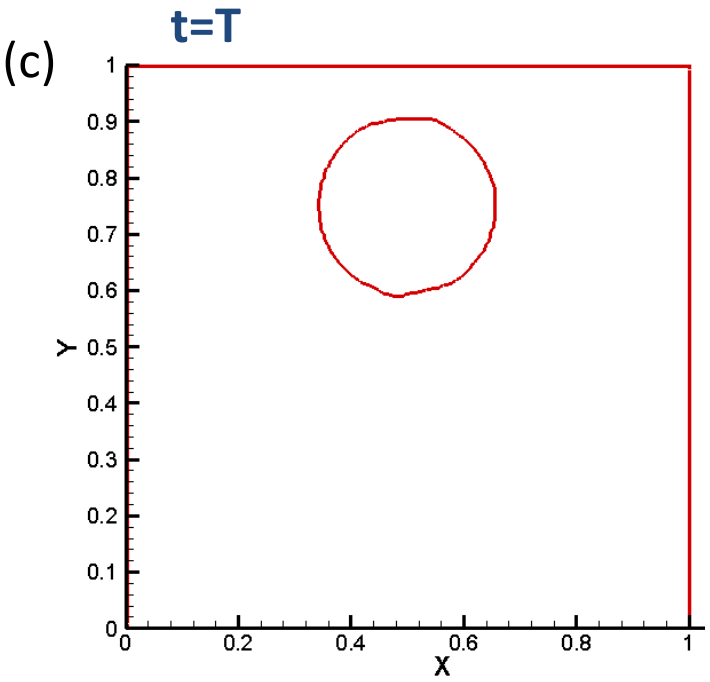


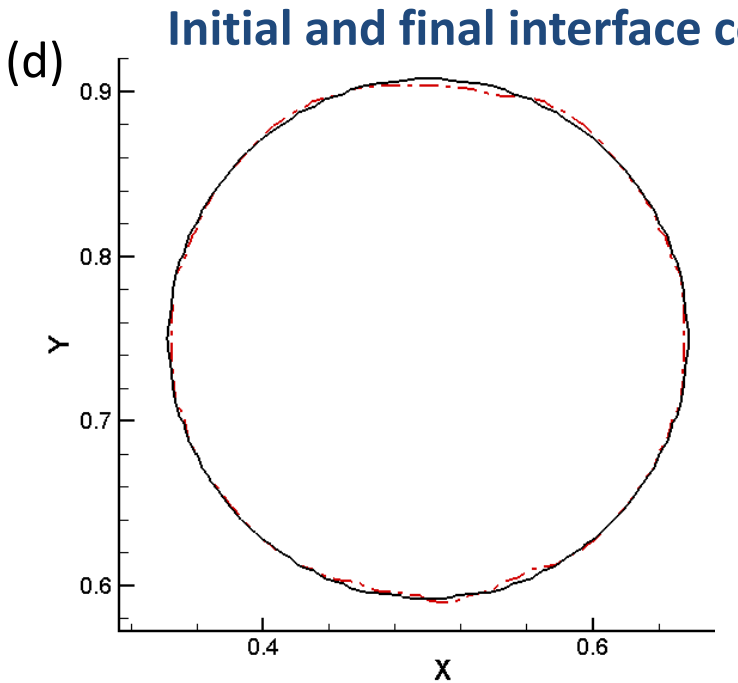
Droplet movement due to a vortex velocity field — coarse_T=6 s



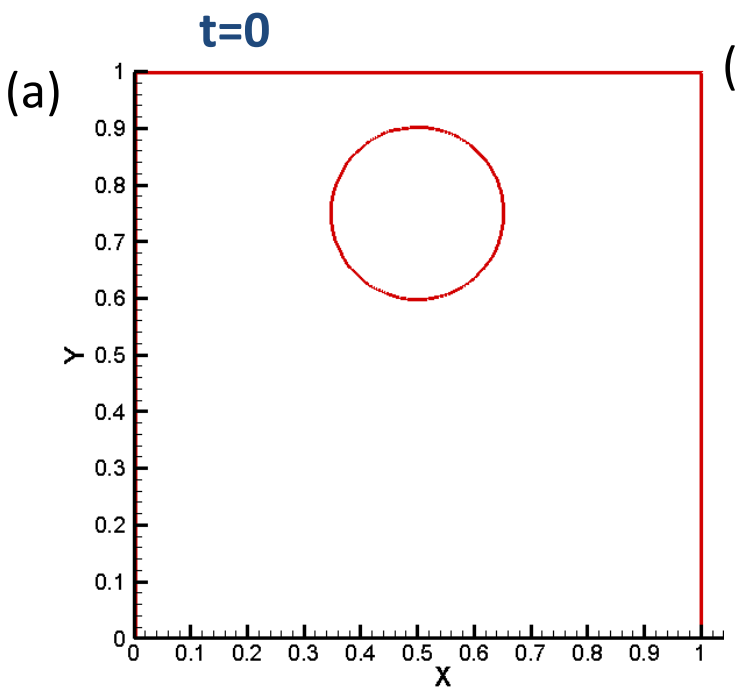


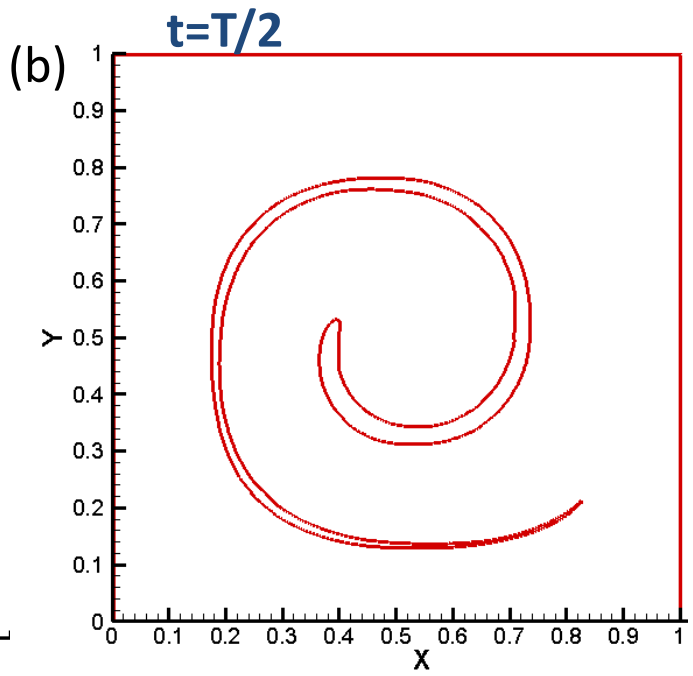
Units for x and y: m



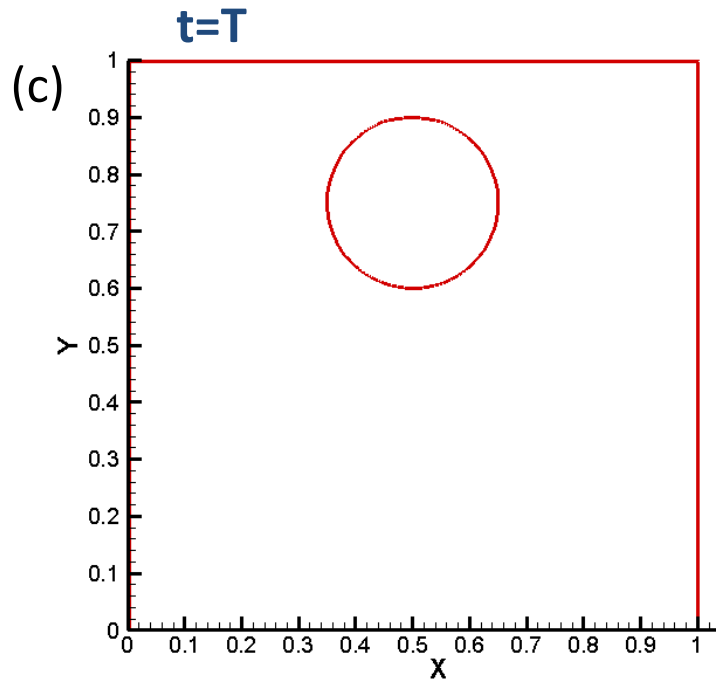


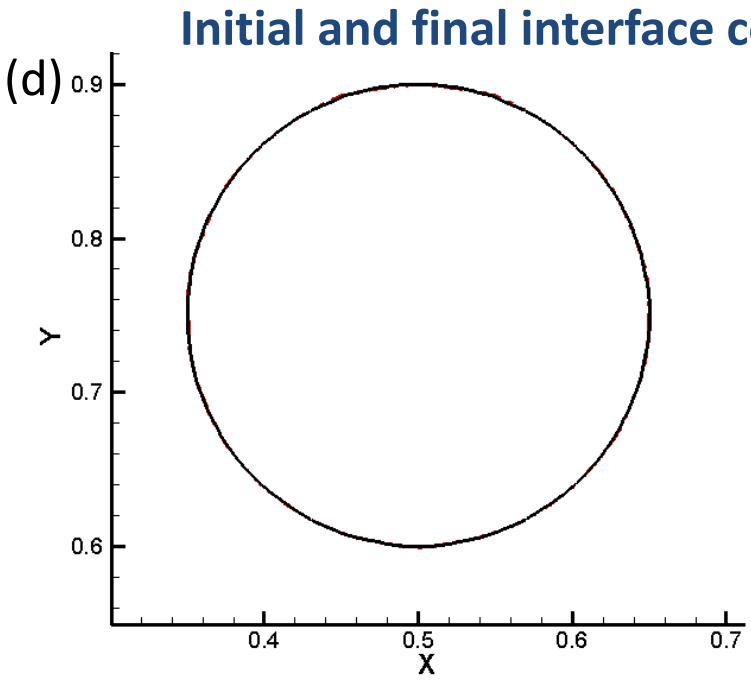
Droplet movement due to a vortex velocity field — fine_T=6 s



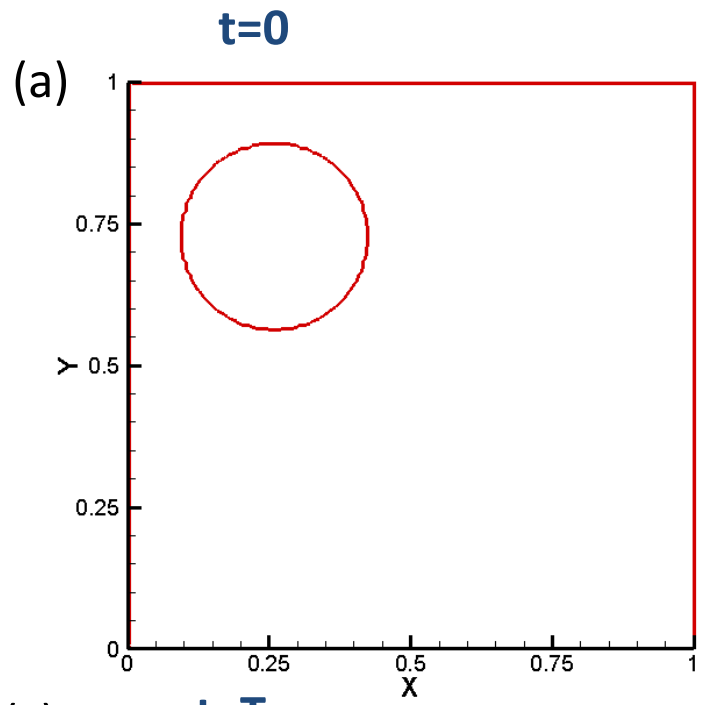


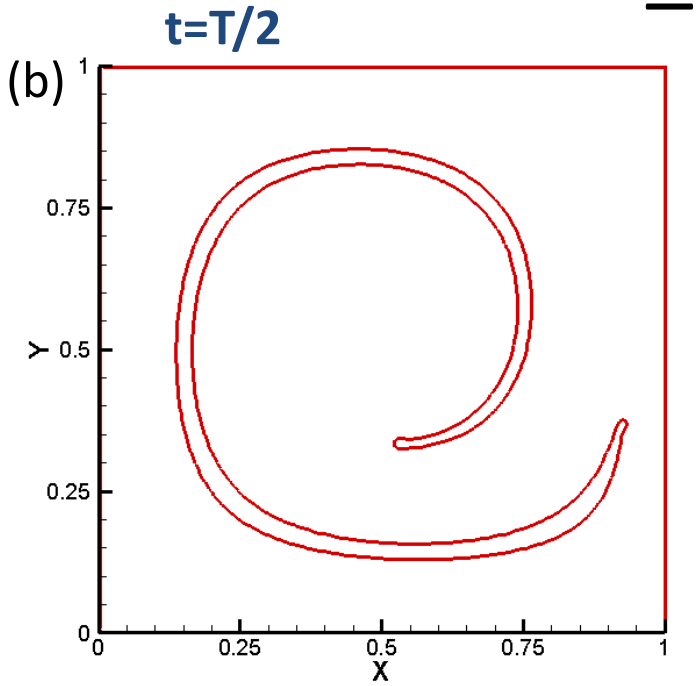
Units for x and y: m



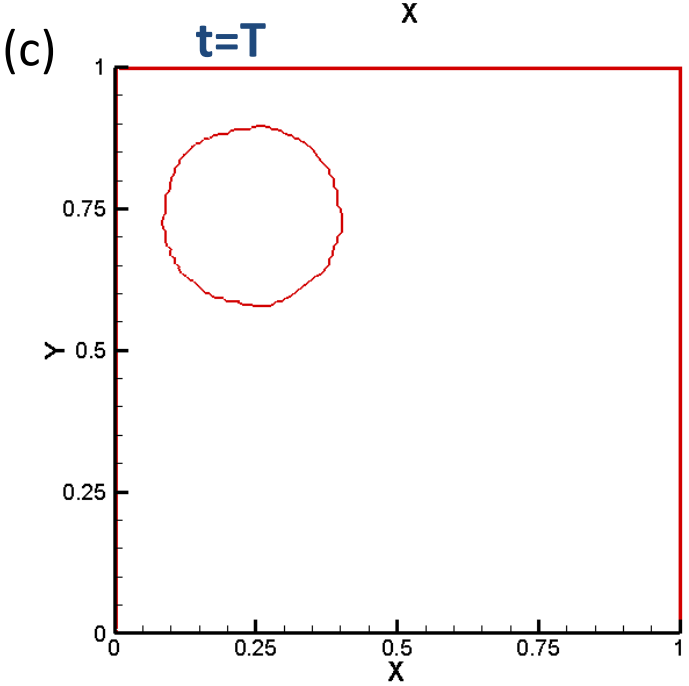


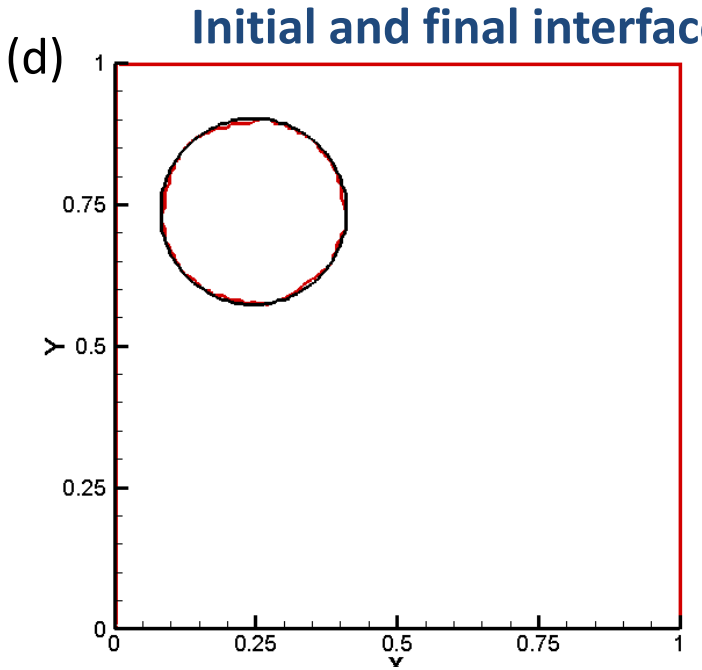
Droplet movement due to a vortex velocity field — FLUENT_coarse_T=6 s





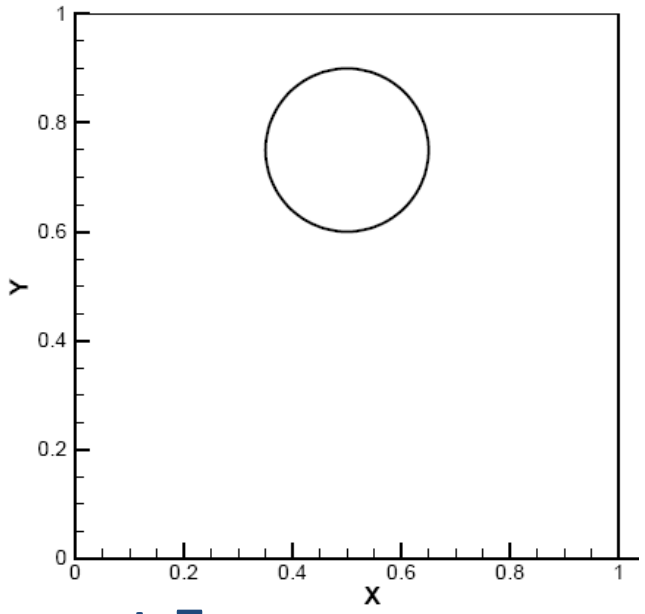
Units for x and y: m



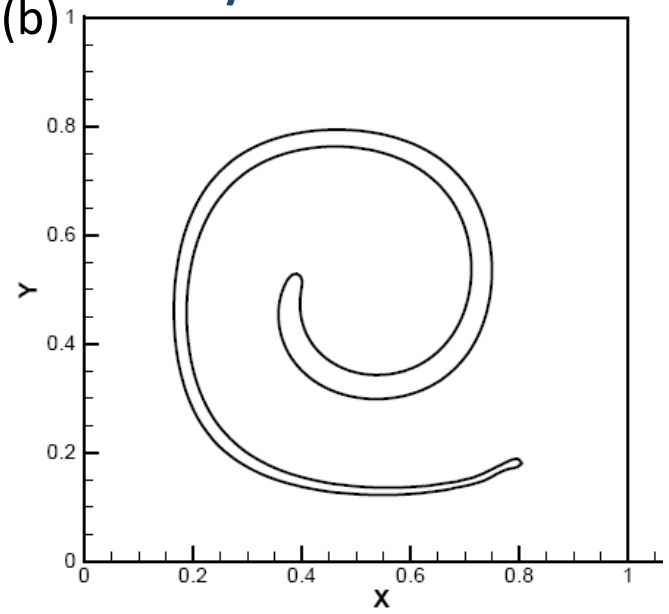


Droplet movement due to a vortex velocity field — Nichita_coarse_T=6 s

(a) **t=0**

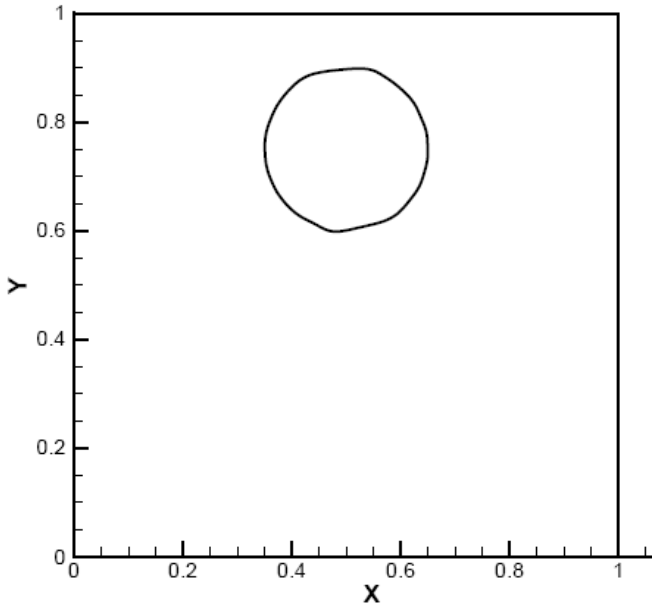


(b) **t=T/2**



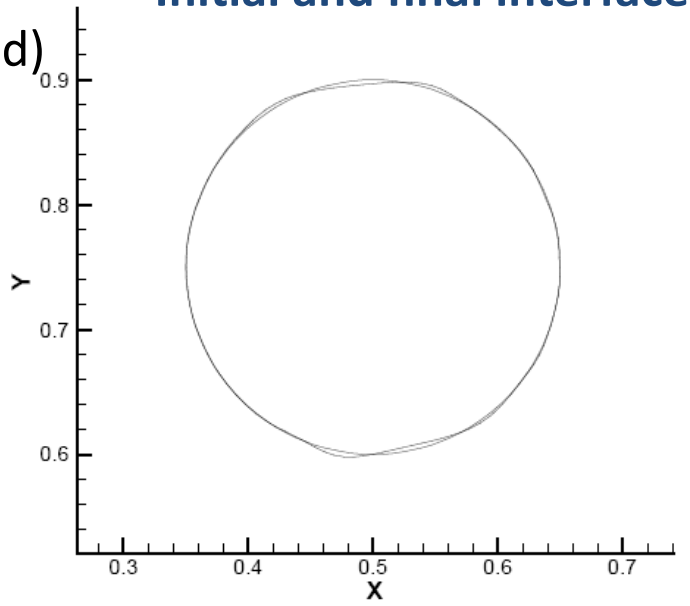
Units for x and y: m

(c) **t=T**



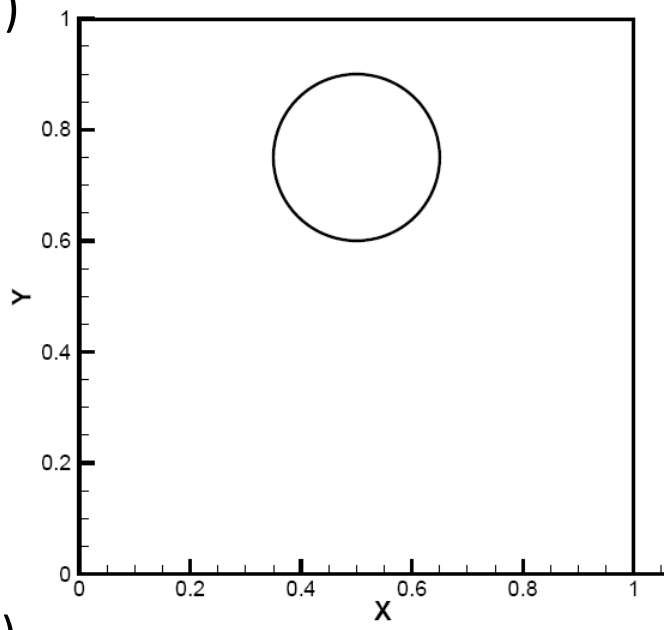
Initial and final interface comparison

(d)

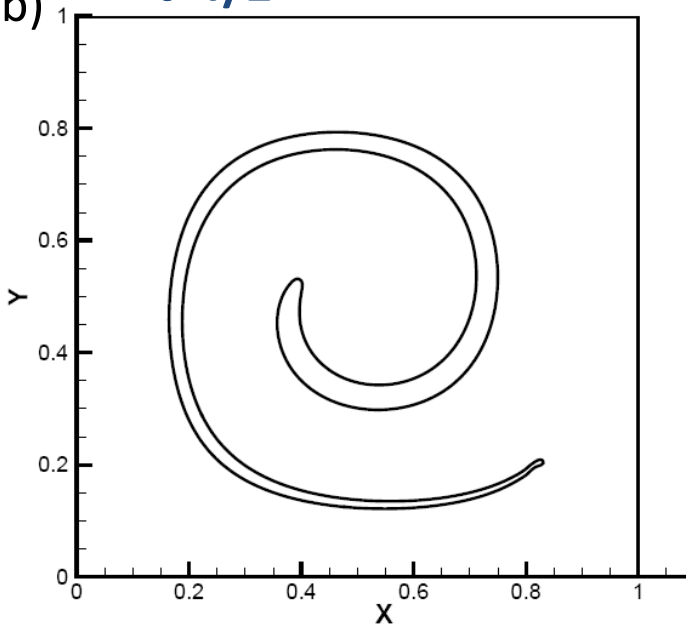


Droplet movement due to a vortex velocity field — Nichita_medium_T=6 s

(a) **t=0**

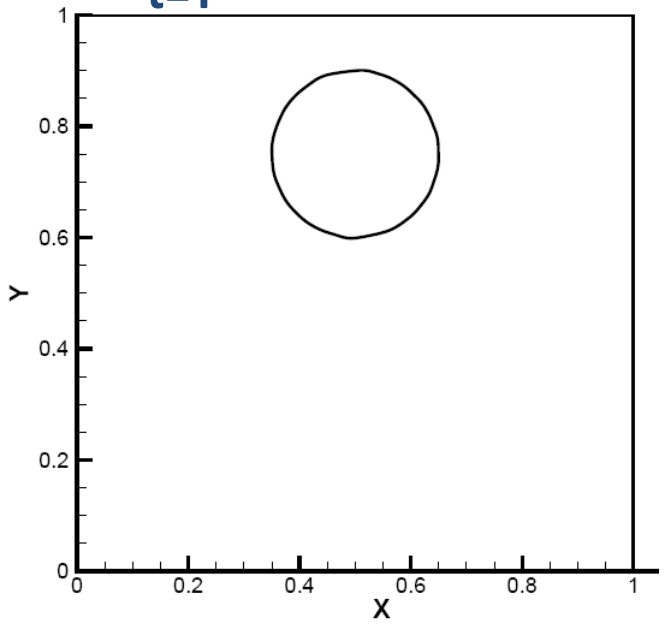


(b) **t=T/2**

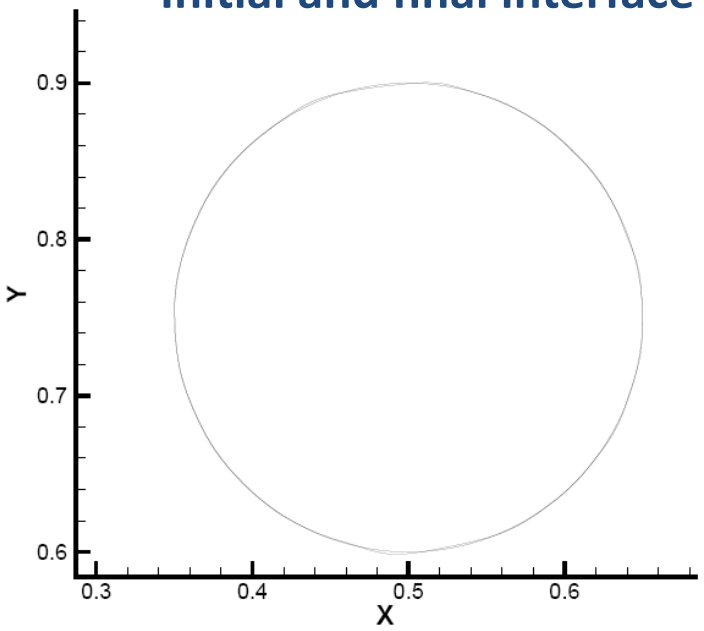


Units for x and y: m

(c) **t=T**



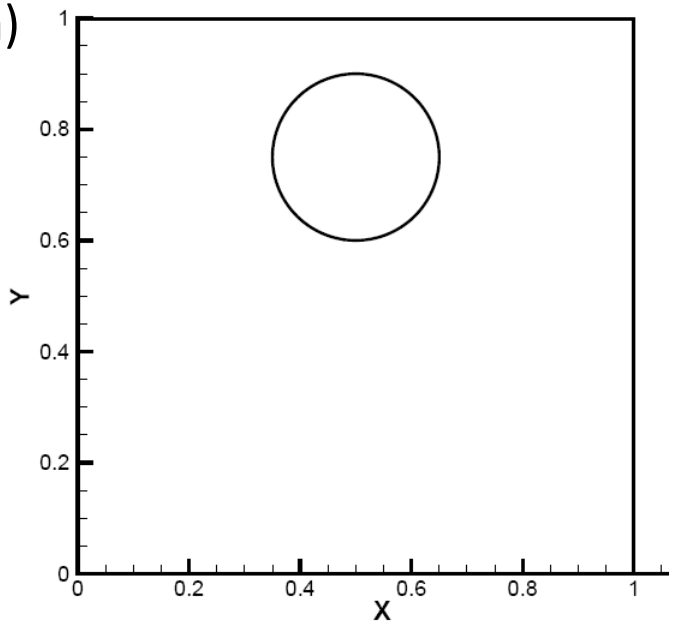
(d) **Initial and final interface comparison**



Droplet movement due to a vortex velocity field — Nichita_fine_T=6 s

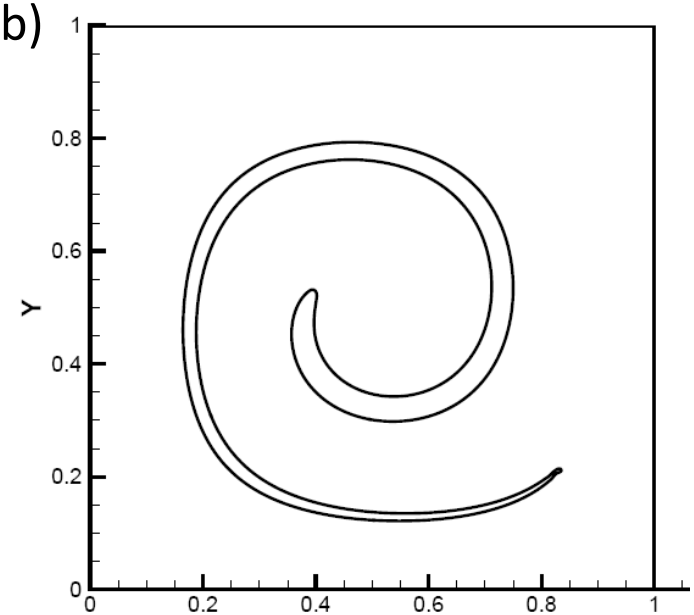
t=0

(a)



t=T/2

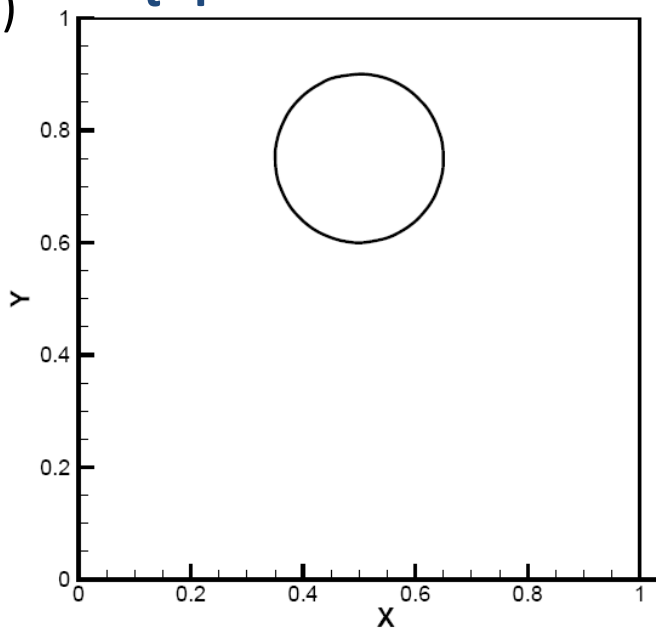
(b)



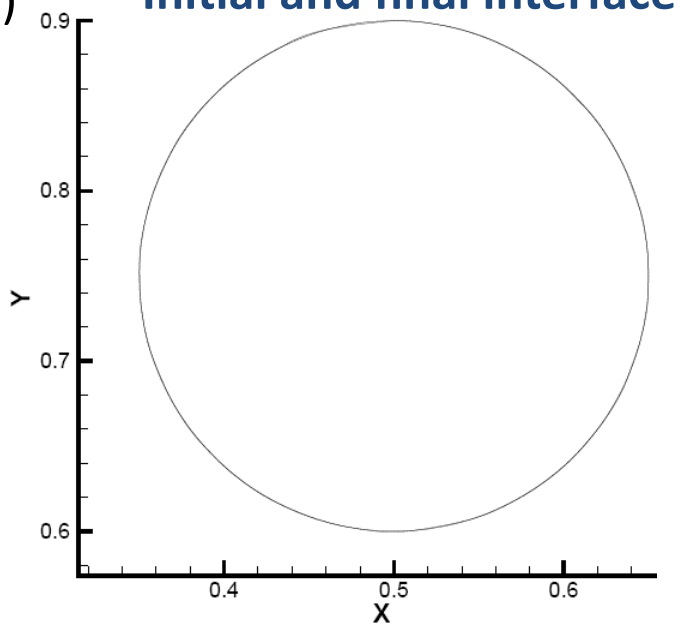
Units for x and y: m

t=T

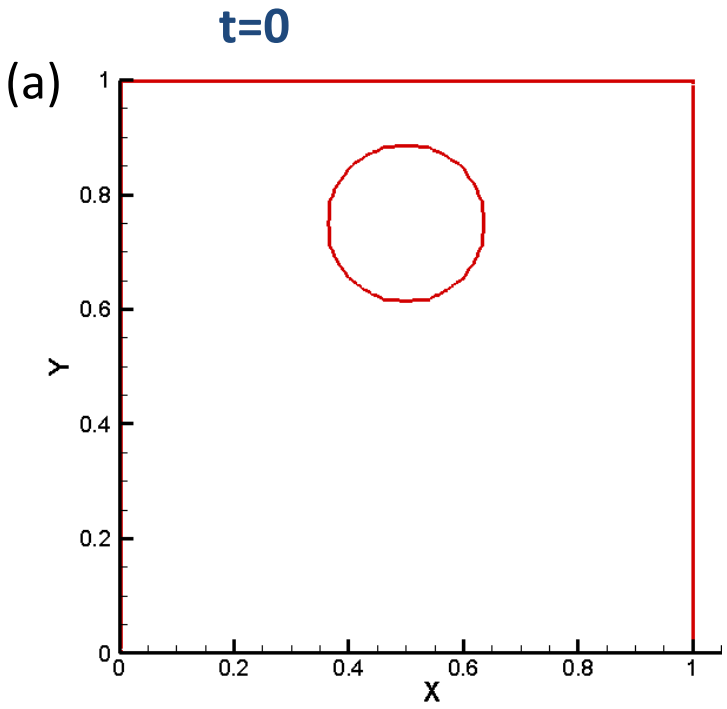
(c)

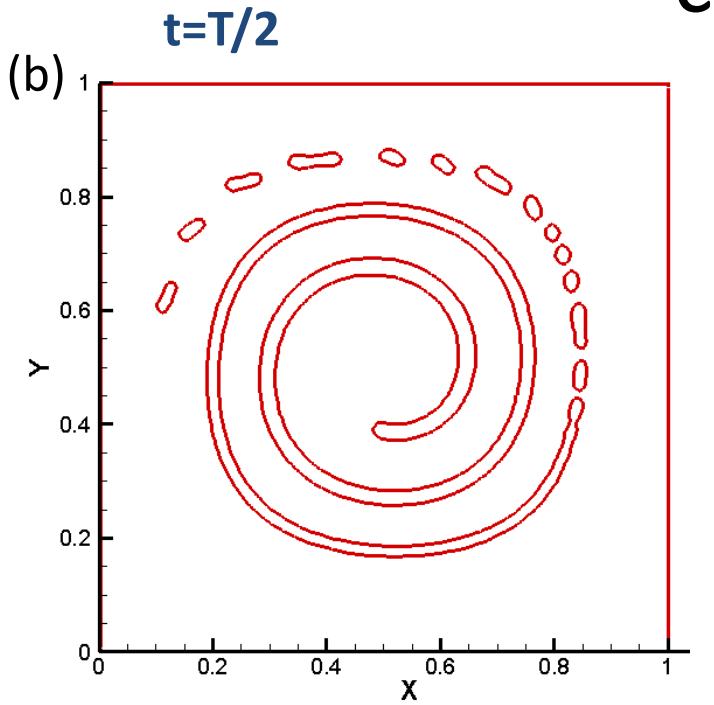


(d) **Initial and final interface comparison**

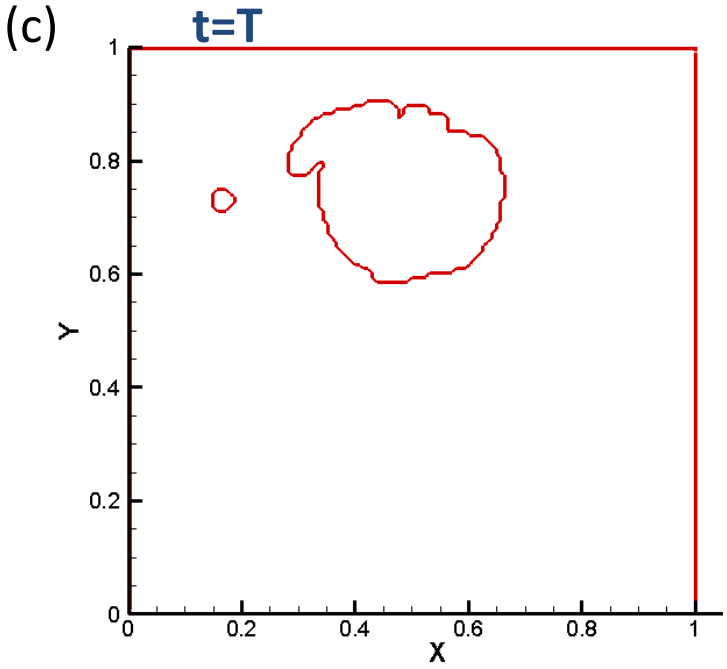


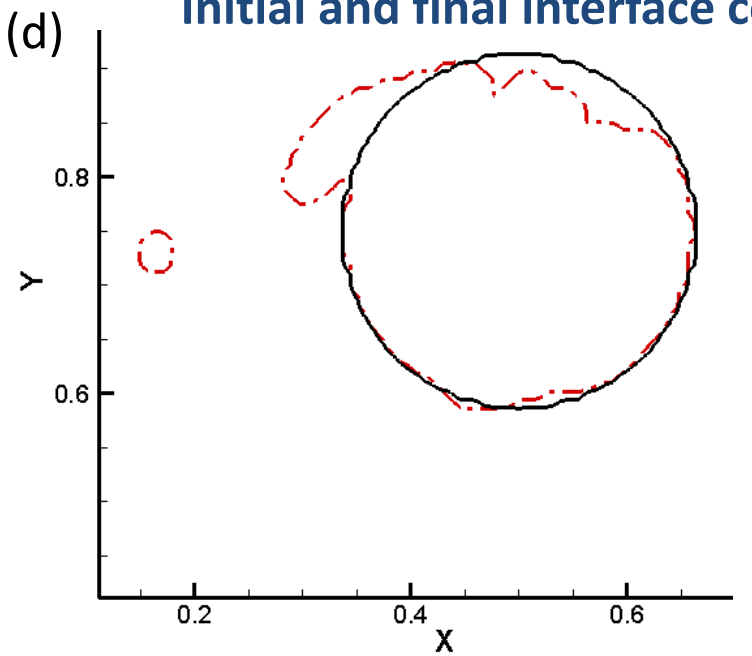
Droplet movement due to a vortex velocity field — coarse_T=12 s





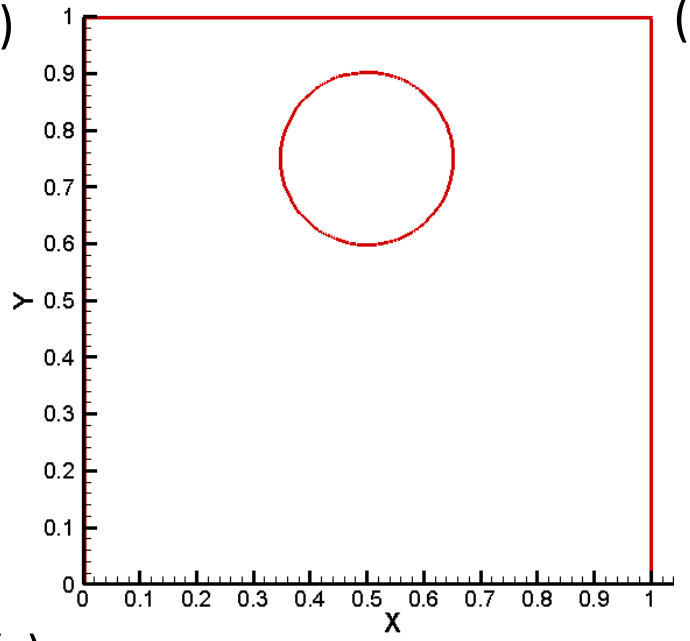
Units for x and y: m



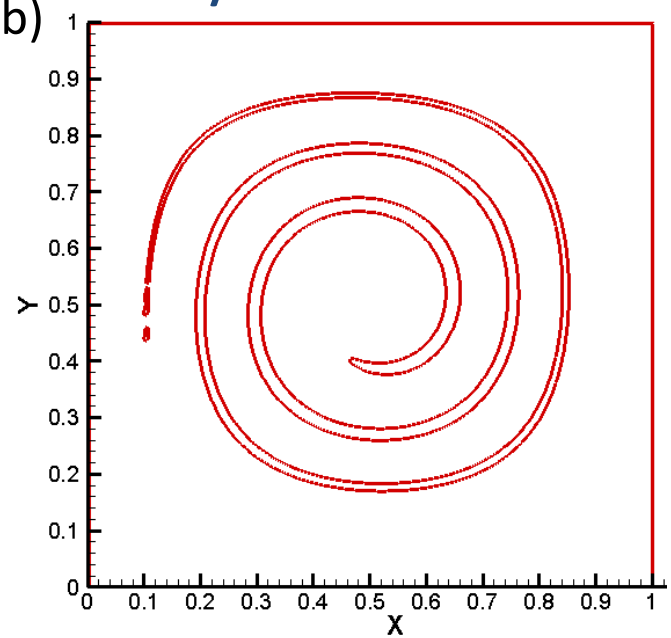


Droplet movement due to a vortex velocity field — fine_T=12 s

(a) t=0

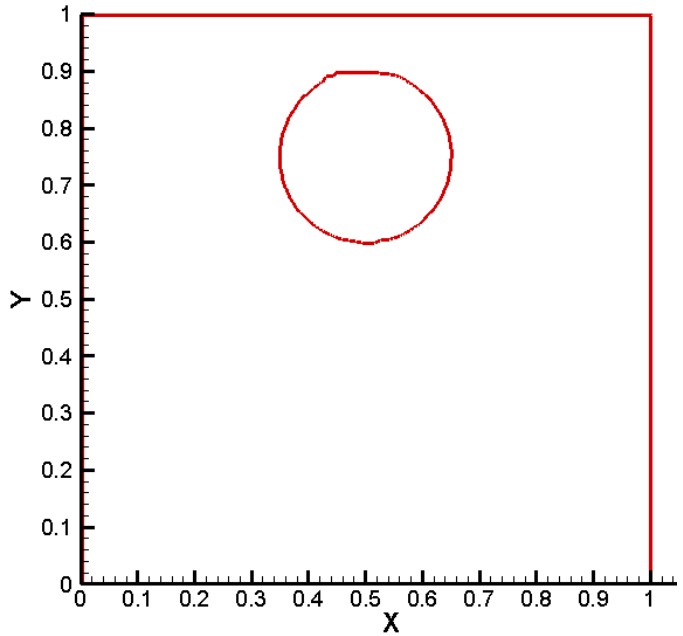


(b) t=T/2



Units for x and y: m

(c) t=T



(d) Initial and final interface comparison