

Visualizing motion of vortex patches at a wall

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1 AIM

To determine the movement of two identical vortex patches that have opposite strengths of same magnitude near a wall with the use of image vortex method .

2 Code working

In the previous computation we have already determined the motion of two vortex patches, in this computation we shall look at how two vortex patches move when they approach a wall and how they move after their interaction with the wall.

- Define a Blob Class that contains all the required parameters.
- Give the following inputs in the script
 - N-Number of Blobs in each patch
 - dt-Time interval for each position change calculation
 - c-No. of iterations of dt time
 - distance-distance between the centre of masses of the patches
 - Gamma,Gamma2-Vortex strengths of the both the vortices under observation respectively
 - blobsize-Radius of each blob
 - wallOrdinate- yaxis position of the wall
 - initVelocity-initial velocity given to all the blobs under question
- Distribute centres of the N blobs uniformly in each patch including the image vortex patches
- Plot the intial distribution
- Calculate the velocity of each blob due to all the other blobs and displace by vdt. If it is impinging a wall modify this to calculate the displacement after collision and coming back
- Plot the new distribution as and when required (once every 1 sec in this simulation)
- Plot the final distribution after c iterations

3 Observations

No. of blobs is taken $N=100$ per patch for computations as higher number of blobs tend to be very time taking to compute.

Initial velocity of 100 in the y direction is given for blob movement

The following cases were simulated and their videos are attached.

- distance $d=1000$, $\Gamma=2000, \Gamma=-2000$
- distance $d=1000$, $\Gamma=-2000, \Gamma=2000$
- distance $d=2000$, $\Gamma=-2000, \Gamma=2000$
- distance $d=200$, $\Gamma=2000, \Gamma=2000$
- distance $d=500$, $\Gamma=2000, \Gamma=2000$