

Answer Sheet

Problem # 1: Lid Driven Cavity Flow:

- a) Plot and discuss the velocity (separate for U and V) contours and velocity vector, on a grid size of 32×32 , at $Re=100$ and 400 (3+3 figures).

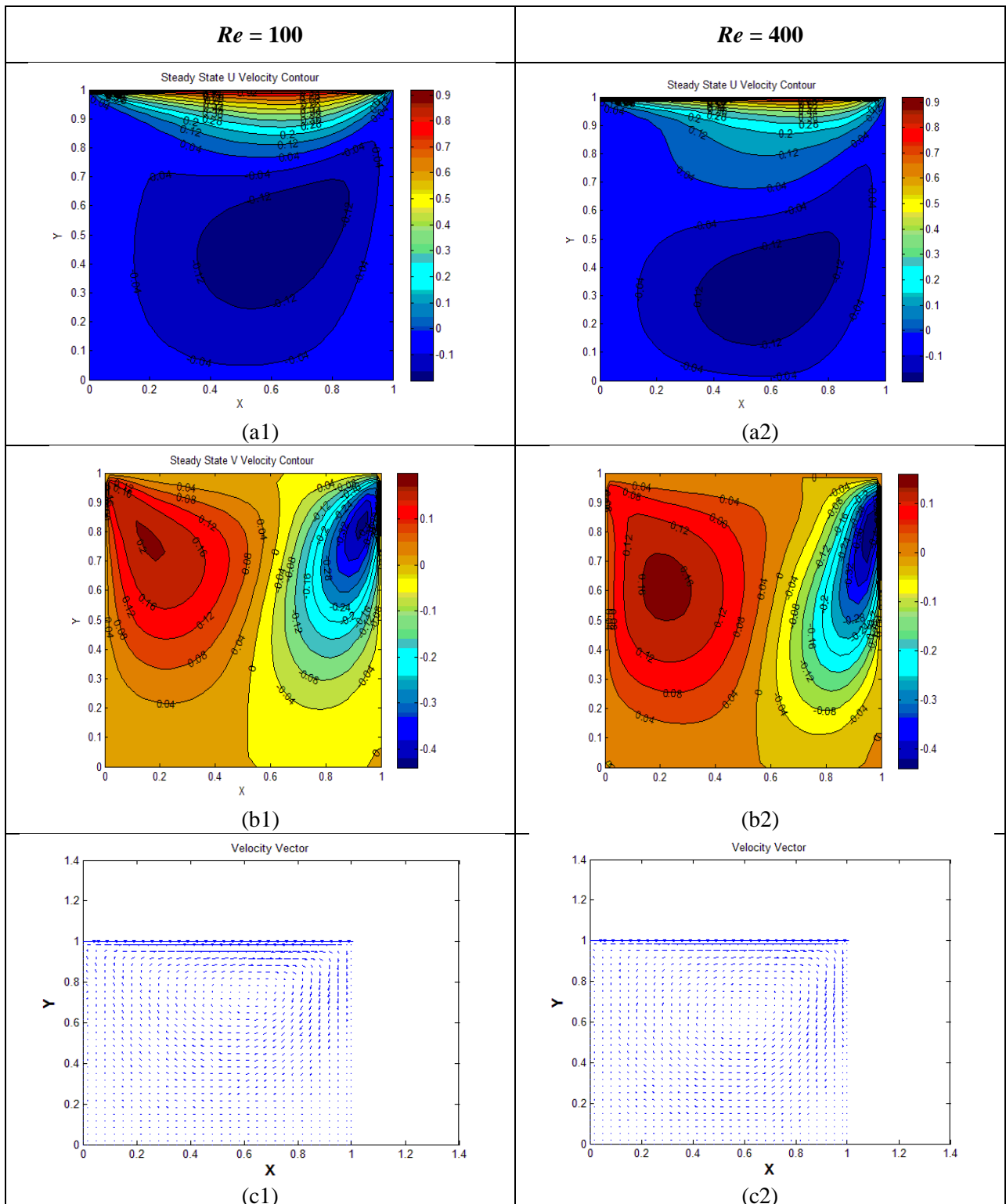


Fig. 5.1: Steady state results obtained for a lid-driven cavity, on a grid size of 32×32 , at $Re=100$ and 400 : (a) U -velocity contour (b) V -velocity contour and (c) velocity vector.

- b) Plot and discuss the variation of U-velocity along the vertical and V-velocity along the horizontal centerline of the cavity and its comparison with the benchmark results, on a grid size of 32×32 , at $Re=100$ and 400 (2+2 figures). Overlap the results obtained by Ghia et al. (Journal Of Computational Physics, 1982, Vol. 48, pp.387-411), with symbols for published and line for present results.

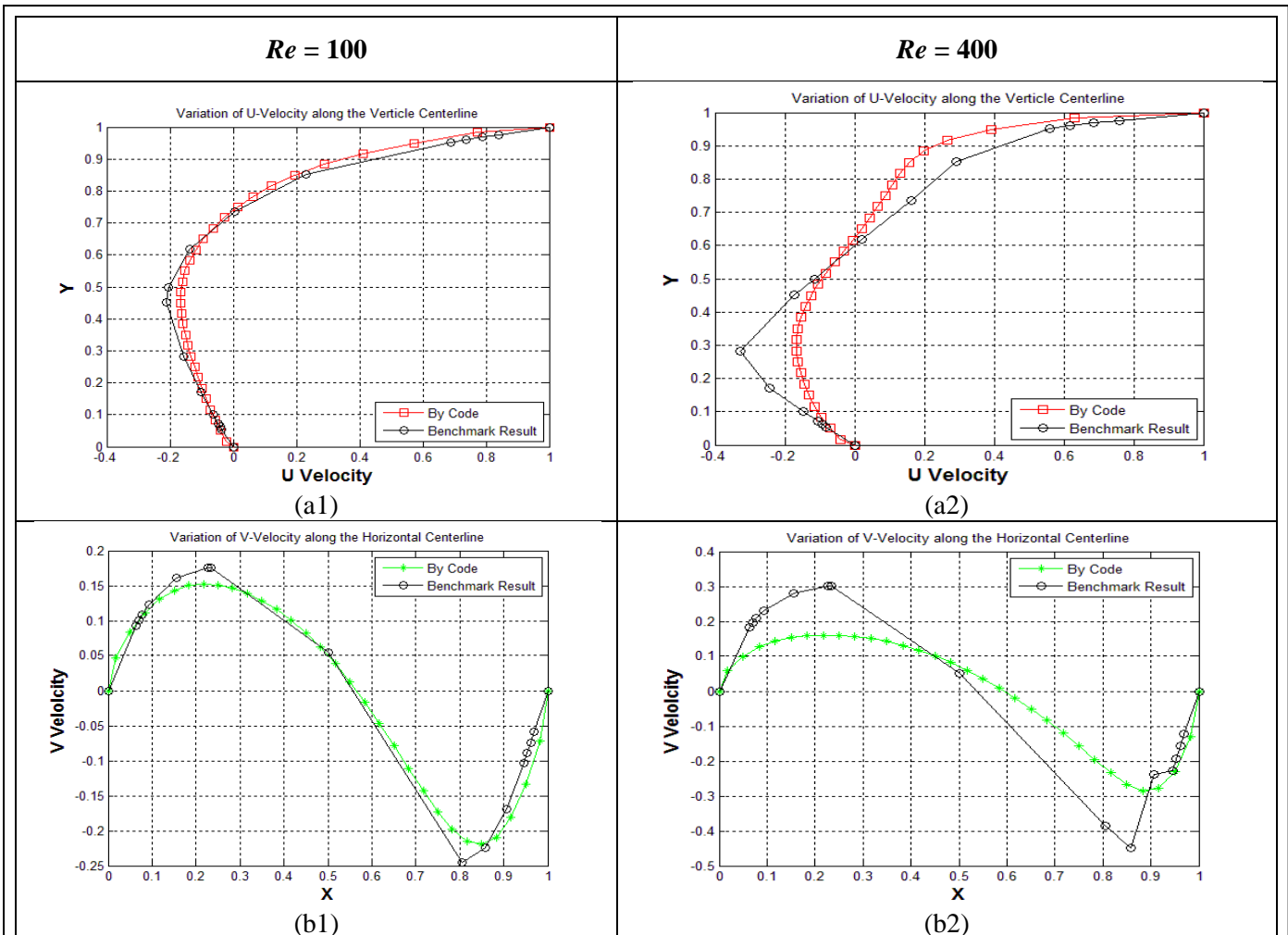


Fig. 5.2: Steady state results obtained for a lid-driven cavity, on a grid size of 32×32 , at $Re=100$ and 400 : (a) U-velocity along the vertical centerline (b) V-velocity along the horizontal centerline. Here, the symbols and lines represent published and present results, respectively.

Discuss Fig. 5.1 and 5.2 here, limited inside this text box only

- From the U Velocity contour for both Re values, it can be seen that U velocity is 1 at top and then decreases when going down and becomes negative after some point and again zero at bottom. It shows that a Circular/Closed flow pattern is created.
- From the V Velocity contour for both Re values, it can be seen that V velocity is positive in the left half and it is negative in the Right half and zero at the boundaries. It also shows that a Circular/Closed flow pattern is created.
- From the Velocity vector of both Re values, it can be seen that velocity is one at top layer and zero at other boundaries. Its direction is changing within domain. Velocity field is also showing closed patterned flow.
- Shape of U, V contours and Velocity vector is almost similar in both the Re values cases, but exact values are different.
- U velocity at vertical centerline is zero at bottom, then becomes negative when going up, then becomes positive after some distance and finally becomes one at top boundary.
- V Velocity at horizontal centerline is zero at left boundary, then it increases up to some distance when moving towards right, then it starts decreasing and eventually becomes negative after some distance, then it again starts increasing and finally becomes zero at right boundary.
- Both of these variations of U and V velocity profiles again denotes closed flow pattern.
- On comparing with benchmark results, we can see that, results are very close to benchmark results for $Re=100$. But for $Re=400$, results are following similar pattern but not very close to each other.