

# Steady Flow Past a Cylinder - Verification & Validation

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## Verification & Validation

1. Assess linearization error: Compare the total, form, and skin friction drag coefficients when the residuals have dropped to  $1E-3$ ,  $1E-6$ , and  $1E-9$ . At what level of residuals is the linearization error small enough?
2. Assess truncation error: Refine your mesh from  $192 \times 96$  cells to  $384 \times 192$  cells. Keep the same bias factor (460). Compare the total, form, and skin friction drag coefficients on the two meshes. Compare gauge pressure vs. on the cylinder surface for the two meshes by plotting them in the same figure. Is the level of truncation error small enough on the original mesh or is additional mesh refinement needed?
3. Assess effect of truncating infinite solution domain: Re-do the solution on the original mesh ( $192 \times 96$  cells) with the outer boundary now at  $128d$ , with the bias factor at 920. Check if the new bias factor will keep the height of the first cell adjacent to the cylinder surface nearly the same as the original mesh. Compare total, form, and skin friction drag coefficients with their original values. Compare total drag coefficient with values in "A Numerical Study of Steady Viscous Flow Past a Circular Cylinder (Fonberg 1980). Comment on the effect of outer boundary location.

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