User Defined Functions - Numerical Solution

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Numerical Solution

A UDF is needed to calculate the lift force over the entire cylinder by integrating the pressure over cylinder segments set to "wall" or "velocity inlet". We cannot use the in-built lift calculator for this case because it does not consider segments set to "velocity inlet." **Important point to keep in mind: The UDF only affects the post-processing of the lift coefficient. It does NOT change the base numerical solution.** The strategy for computing the lift force using the UDF is as follows:

1. Turn on a 'user defined scaler' which Fluent will solve for
2. On the cylinder surface, set the below equation by implementing the UDF as a boundary condition for

$$\sigma = -p\sin(\theta) \qquad (1)$$

3. Run at least one iteration to integrate over the cylinder surface

Note that the liftFunc UDF calculates a side force that is NOT normalized. So you'll have to divide the reported value by 0.5*rho*v^2*D*1 to get the normalized side force. This is because when you integrate liftFunc, you get the integral of -p*sin(theta) on the chosen surfaces.

User-defined function implementation to obtain the lift coefficient around the cylinder is as follows.

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