Numerical simulation of turbulent pipe flow with elbow bend: comparison between RANS and LES

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Published in:
32nd Scottish Fluid Mechanics Meeting (SFMM)

Publication date:
2019

Numerical Simulation of Turbulent Pipe Flow with Elbow Bend: Comparison between RANS and LES

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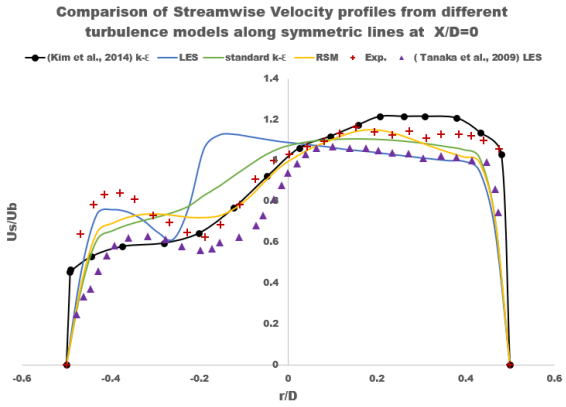
Primary and secondary flow in 90-degree pipe elbow with curvature radius ratio of $R_c/D = 2$ and Reynolds Number = 60,000 is investigated using CFD to evaluate relative performance between RANS (standard *k-ε* and RSM) and LES turbulence approaches. The present numerical results are compared against both experimental data (Sudo et al., 1998) and numerical simulations (Kim et al., 2014).

In previous publications, RANS and LES have been investigated separately for different flow regimes (based on different Reynolds numbers and curvature radius ratios). The current work aims to make direct comparison between the two different turbulence approaches against validation data and preliminary results are presented in the figure below.



The results indicate that RSM predicts the flow regime sufficiently accurate and is less computationally expensive than LES. The computed flow field variables will be coupled to ANSYS Mechanical to model the structural response of the pipe and subsequently the induced vibration.

KIM, J., et al. (2014) Characteristics of Secondary Flow Induced by 90-Degree Elbow in Turbulent Pipe Flow. *Engineering Applications of Computational Fluid Mechanics,* **8** (2), 229-239.

SUDO, K., et al. (1998) Experimental investigation on turbulent flow in a circular-sectioned 90-degree bend. *Experimental Methods and their Applications to Fluid Flow,* **25** (1), 42-49.