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Numerical and Experimental Investigation of the Turbulence Level Influence on the Flow through the Staggered Smooth Tube Bundle

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Abstract : The present investigation is an experimental and numerical studies of the turbulence level influence on the flow in a smooth staggered tube bundle. The experiments were carried out in a closed circuit wind tunnel of subsonic type (TE44). Three turbulence levels at the inlet namely 1%, 4.6% and 6.3% and two Reynolds numbers Re = 9300 and Re = 13950 were performed. The obtained results for the central tube show that there are two minimum values for the angles 70° and 280° corresponding to the separation points. The pressure coefficient distributions seem to have constant values between 120° and 240° resulting in Von Karman street configuration in the wake. These remarks were valid for the tests carried out. The numerical study was performed by the ANSYS FLUENT code which solves the averaged Navier-Stokes equations (RANS). Two turbulence models (k-ε RNG and k-ε realizable), two types of grids and two levels of turbulence at the entrance of 4.6% and 6.3% for Reynolds numbers of 9300 and 13950 were considered. The obtained results for the central tube were compared with the present experimental results. It is concluded that the K-ε realizable is more suitable for the pressure distribution prediction than the K-ε RNG model compared to the present experimental results for this studied case.

Keywords : tube bundle, staggered configuration, turbulence level, numerical, experimental
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