Turbulence Modelling of Impinging Jets.
Application to Air Curtains.

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Abstract
The work has a double purpose. The first one is focussed on the basic and fundamental analysis of turbulence models performance in impinging jets. In the second part the know-how acquired is applied to the study of air curtains, which are generally a set of vertical or horizontal plane jets used as ambient separator.

Different impinging jet configurations (plane and round)[1, 2] are studied by means of time averaged Navier-Stokes simulations (RANS), using structured and staggered grids. Within RANS, explicit algebraic Reynolds stress models and both non-linear and linear eddy viscosity models are explored jointly with $k-\epsilon$ and $k-\omega$ platforms. [3]. Afterwards, attention is focussed on situations involving air curtain surroundings. Results of selected turbulence models are compared with experimental data. Then, examples of the unsteady three-dimensional study of the dynamic behaviour of a refrigerated chamber, when its door is suddenly opened, and maintained opened during a certain time are presented. Air curtains are used in this application to reduce the refrigerated chambers heat gains [4].

Finally, in order to study the discharge plenum geometry and the presence of blades for flow orientation at the exit of air curtains mounted above doors, a different approach based on unstructured and collocated grid, using symmetry-preserving formulation [5] is used. To solve turbulence, and by taking advantage of the even increasing computational power and solvers available, coarse Direct Numerical Simulation (cDNS), Large Eddy Simulation (LES) [6], and hybrid RANS/LES models [7] are selected. This analysis is carried out to understand the influence of these constructive elements on the characteristics of the jet produced.

References


