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# 2D and 3D URANS Numerical Analysis of Turbulent Swirling Flow in A Gas Turbine Combustion Chamber

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## Résumé

Turbulent swirling flow in can-type model of a gas turbine combustor is computationally investigated. As the basic modeling strategy, a 2D and 3D Unsteady RANS (URANS) approach is applied, employing a differential Reynolds Stress turbulence model (RSM) and Reynolds stress turbulence model (SST k- $\omega$ ) (Table 1). A highly unsteady and three-dimensional flow structure, exhibiting vortex breakdown and a processing vortex core are observed. The aim of this study, is the compared between two turbulence model. This comparison is performed for the geometry with swirled burner. Figure 1 compares the predicted distributions of the time-averaged circumferential velocity, along a traversal line at  $y = 0.2\text{m}$ , for different turbulence modeling approaches, one can see that 3D URANS SST over-predicts the size and intensity of the recirculation zone compared to 3D URANS RSM. the 2D RANS SST results predict an even larger recirculation zone and a broader vortex core with smaller maximum velocities compared to 3D URANS SST k- $\omega$ . It is already mentioned above that no convergence could be obtained by 2D RANS RSM, which can be seen as the manifestation of the ability of RSM to capture low frequency flow unsteadiness. the 2D URANS RSM results displayed in the figure predict a qualitatively complete different circumferential velocity field, implying a region of forward flow, central jet: enveloped by a recirculation zone. The circumferential velocity profiles of 2D URANS RSM also differ considerably from those of 3D URANS RSM. This comparison shows the importance of three-dimensional effects combined with flow unsteadiness.

**Mots-Clés:** Gas turbine, SST k, epsilon model, RSM, URANS equations

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