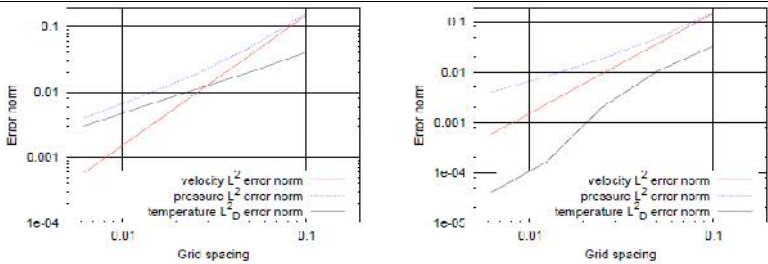


Support to Safety ANALysis of Hydrogen and Fuel Cell Technologies

<b>Verification type</b>	Methodology
<b>Database reference</b>	MET-4
<b>Topic / Application</b>	Methodology Analytical Manufactured Numerical benchmark Fires Nuclear Safety
<b>Physics</b>	Taylor-Green Natural Convection Heated cavity
<b>Summary</b>	a computational code, named ISIS, dedicated to the simulation of buoyant re in a mechanically ventilated compartment, undergoes an range of verification and validation procedures, applied to buoyant flows with heat exchange (e.g. fire simulation)
<b>Description</b>	A new RANS code (ISIS) is developed for use in simulation of fires. Application includes nuclear safety. For the verification of the code, a wide range of techniques is employed: comparison to analytical solution for model problems, use of manufactured solution and comparison to benchmark result. The paper shows the application of each test and in all cases, convergence properties of the scheme are assessed.
<b>Case Title</b>	Verification and Validation of the ISIS CFD Code for Fire Simulation
<b>Authors</b>	S. Suard, L. Audouin, F. Babik, L. Rigollet, J.C. Latch
<b>Year</b>	
<b>Online reference</b>	ISO/TC 92/SC4 Workshop on Assessment of Calculation Methods in FSE
<b>Case image</b>	 <p>Left plot: Error norm vs Grid spacing for upwind approximation scheme. Right plot: Error norm vs Grid spacing for 2<sup>nd</sup> order scheme. Both plots show velocity <math>L^2</math> error norm, pressure <math>L^2</math> error norm, and temperature <math>L^2</math> error norm. The x-axis (Grid spacing) ranges from 1e-04 to 0.1. The y-axis (Error norm) ranges from 1e-04 to 0.1. The 2<sup>nd</sup> order scheme shows a steeper slope, indicating higher convergence rates compared to the upwind scheme.</p> <p>Error norm for velocity pressure and temperature with upwind approximation scheme (left) and 2<sup>nd</sup> order scheme (right) in the</p>

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	transport equation.
<b>Governing equations</b>	$\nabla \cdot \mathbf{v} = 0$ $\frac{\partial \mathbf{v}}{\partial t} + (\mathbf{v} \cdot \nabla) \mathbf{v} = -\nabla p + \frac{1}{Re} \nabla^2 \mathbf{v} + \frac{Ra}{Pr Re^2} \theta \mathbf{k} + \mathbf{S}_v$ $\frac{\partial \theta}{\partial t} + \mathbf{v} \cdot \nabla \theta = \frac{1}{Pr Re} \nabla^2 \theta + S_\theta$ <p>These NS conservation equations are solved using a MMS scheme for verification comparison</p>
<b>Results</b>	