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Natural Convection for Anomalous Density Variation of Water – Numerical Benchmark

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A steady state natural convection in a differentially heated cavity for temperatures in a vicinity of the freezing point is used to investigate and compare performance of four different numerical methods: finite differences, finite volume, finite elements and mesh-free diffuse approximation method. A primary aim of the exercise is to define a new numerical benchmark solution for natural convection problems, which includes challenging configuration of strongly non-linear buoyancy term. This configuration is used to test performance of two popular commercial codes (Fluent and Fidap) and to compare them with two “classical” finite difference codes and the new promising mesh-free implementation.

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