

# Hybrid RANS turbulence Reduced Order Models for Heat Transfer Fluid

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We present a Reduced Order Method (ROM) approach using hybrid RANS turbulence model to the heat exchange in a fluid of cylindrical irradiated pipes of a simulated 3D cavity of CSP tower receivers. These simulations often entail a very high computational cost thus, to drastically reduce it, we have developed a ROM for this industrial application. We validate the proposed method in a 2D Boussinesq model problem for natural convection monitoring temperature, pressure and velocity for different values of the Rayleigh number. For the 3D forced convection problem of Heat Transfer Fluid (HTF) running through the irradiated pipes, we compute the snapshots with Ansys Fluent in a realistic model of a pipe flow in a solar receiver, with the mass flow inlet as varying parameter. The ROM is developed using the open-source software FreeFEM. The reduction in computational time can be up to three orders of magnitude with relative errors of  $10^{-3}$ .

## References

- [1] J. Valverde, J. Galán Vioque, J.C. Herruzo, S. Rubino and C. Núñez, Reduced Order Modelling for the optimization of CSP tower receivers and their cavities for high temperature applications. *SolarPACES2022 Proceedings: Analysis and Simulation of CSP and Hybridized Systems*, Vol. 1, pp. 1–8, 2023.

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