

# **Direct Numerical Simulation and Modeling of Turbulent Convection in Porous Media**

## **Abstract**

Turbulent convection in porous media receives increasing attentions in recent years with the emergence of some new engineering applications. These applications include long term storage of CO<sub>2</sub> in deep saline aquifers, cooling systems of electric devices, and thermal energy storage systems, etc. Turbulence plays an important role in these applications since it can effectively enhance the heat and mass transfer. The main purpose of the proposed project is to better understand the physics of turbulent porous medium convection. Microscopic direct numerical simulation (MIC-DNS) methods, in which the detailed flows within the porous elements will be taken into account, will be used in the study. Particular attentions will be paid to natural and mixed convection problems due to their high complexity and significance in emerging industries. Through our understanding of physics, a more accurate macroscopic model for calculating turbulent porous medium convection should be developed. The developed model will be validated by our DNS results.