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A (dual) network model for heat transfer in coupled porous media free flow systems

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Heat transfer processes and non-isothermal effects are found in many technical and environmental coupled porous-media free flow systems.
Prominent examples including two-phase flow range from fuel-cell water management
and food drying to soil evaporation and salinization. Modeling these types of systems is challenging due to the variety of length and time scales involved and the high physical complexity of the processes

In this work, we introduce a fully coupled, locally energy- and mass-conservative dual
network model for the simulation of heat transfer in realistic natural porous media, allowing the consideration of pore-local thermal non-equilibrium and structural heterogeneity coupled with a free flow system . Energy transfer in the dual network is modeled as a fully coupled processes using pore and grain-local heat transfer rules derived from the analysis of local idealized but spatially resolved problems and geometrical considerations. he solid space. Both porous media subdomains are simplified using the same model reduction technique commonly applied exclusively to the void space, where it is known as pore-network modelling.

Using selected examples, we will show the conditions under which
thermal non-equilibrium plays a role.

Participation

In-Person

References

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