Abstract:
Deformable porous medium has several applications in geosciences, biological, and energy fields. In such a medium, the pore structure of the medium varies with time leading to alterations in macroscale properties. An example is that of clogging due to the precipitation in subsurface. This may locally arrest the flow. This leads to a change in the flow pattern.
We will discuss some of the recent approaches to study a deformable porous medium. A system of coupled partial differential equations describe this phenomenon. This system of equations has a particular structure: it couples the two scales (microscale and macroscale) as well as describes the flow, transport and reactions. These are convection diffusion reaction type partial differential equations at macroscale coupled to a level set type equation at the pore scale. We will study some solution approaches to these equations. We will also revisit the widely used Kozeny–Carman type relationship between porosity and permeability in the light of the homogenization theory. We will also present extensions to the non-isothermal case.