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Injecting fluid into or pumping fluid out of a wellbore plays a critical role in extracting subsurface energy resources, such as geothermal energy, conventional and unconventional gas, and oil. Maintaining well integrity throughout the whole life cycle of the well from construction to abandonment is a significant issue facing the oil and gas industry. According to statistics, well integrity issues, including borehole breakdown, breakout (collapse), blowout, drilling fluid loss, and well delamination, cost the industry billions of US dollars annually and pose a great risk to the environment and the health of operation workers. An improvement of engineering practices for such a complex system will only come from a better understanding of the mechanism of the different hazards associated with fluid flow and rock deformation during drilling or production of the well.

The fluid flow and its interaction with solid deformation in a wellbore/reservoir system are complex, involving multiphysics (mechanical, thermal, hydro, chemical, etc.), multiphase (gas, solid, and liquid), and multiscale (nano to macro and seconds to year) processes. Phase change (e.g., solid to gas from gas hydrate dissociation), rock damage, or crack propagation resulting from enhancing fluid pressure can further complicate this problem. As there are many factors affecting the fluid flow and mass transfer in the wellbore and formation, the mechanisms behind well integrity are still not completely understood and require further investigation. Hence, proper measure can be taken to prevent the potential hazards during drilling and production. In addition, efficient and effective drilling and completion technologies, such as high pressure water jet and directional drilling, and hydraulic fracturing technology are encouraged to be further explored for a safer and more environment-friendly oil and gas development.

This special issue will collect high-quality original research articles and review papers reflecting the advances in the research on fluid flow and its application in a wellbore/reservoir system and related integrity. They could be based on analytical, numerical studies as well as laboratory experiments. Case studies from practice are also welcome.

Potential topics include but are not limited to the following:

- ▶ Properties of drilling fluids
- ▶ Fluid flow and mass transfer in a wellbore/reservoir system
- ▶ Fluid-induced wellbore stability and integrity problems
- ▶ Mechanism and control of fluid loss during drilling
- ▶ Fluid circulation system
- ▶ Slurry penetration during well cementing
- ▶ Fluid flow and fracture mechanics near wellbores
- ▶ Geothermal energy development and production
- ▶ Phase change related fluid flow, such as natural gas hydrate production
- ▶ Application of fluid flow to field measurements, such as prediction of permeability and in situ stresses

Authors can submit their manuscripts through the Manuscript Tracking System at <https://mts.hindawi.com/submit/journals/geofluids/nwffm/>.

Papers are published upon acceptance, regardless of the Special Issue publication date.

Lead Guest Editor

Bisheng Wu, Department of Hydraulic Engineering Tsinghua University, Beijing, China
wu046@mail.tsinghua.edu.cn

Guest Editors

Fengshou Zhang, Tongji University, Shanghai, China
fengshou.zhang@tongji.edu.cn

Qianbing Zhang, Monash University, Clayton, Australia
qianbing.zhang@monash.edu

Andrew Bunger, University of Pittsburgh, Pittsburgh, USA
bunger@pitt.edu

Brice Lecampion, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
brice.lecampion@epfl.ch

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