Postdoc Research Position
Topic: Large-scale numerical simulation of complex reservoirs at King Abdullah University of Technology (KAUST), Saudi Arabia

Developing and deploying carbon dioxide storage technologies can serve as a transitional strategy as we shift towards a low-carbon economy. They provide a practical solution to address emissions from existing industrial infrastructure while alternative energy sources are being scaled up. Robust computational tools are needed for simulation of field-scale projects of carbon storage. In particular, the modelling of complex processes of the multi-component, multi-phase, multi-modal flow in porous media with strong heterogeneity and anisotropy requires efficient, accurate, and robust numerical simulation techniques. Moreover, in recent years, the resolution of reservoir description has gradually increased due to advancements in well-logging, coring, and other types of data acquisition techniques. However, the complexity of the carbonate reservoir makes it difficult to be characterized by conventional models based on log data. In addition, the size of the geological model grid cell is about 1 foot, whereas, limited by computational capabilities, the grid size of current numerical models is typically 5-6 feet, which is significantly larger than that of the geological model.

To meet the needs of complex reservoir engineering applications and to compute large-scale reservoir simulation problems more rapidly, efficiently, and accurately, numerical algorithms and advanced techniques for large-scale numerical simulation of multi-component flow problems are needed. Through an interdisciplinary research team combining reservoir engineering, applied mathematics, and scientific computing, we will make use of the strength of each party to conduct collaborative research and joint research in mathematical models, numerical methods, parallel algorithms, hardware acceleration, production forecast, history matching, and digital twins.

Together with colleagues from ADNOC and Chinese Academy of Mathematical and System Sciences, we plan to study a carbonate reservoir whose reservoir data show that it contains intergranular as well as intragranular pores and dissolution pores.

The task of the postdoc researcher is to contribute to the applied mathematics and scientific computing aspects of this interdisciplinary research project. The postdoc researcher will design numerical algorithms for simulating large-scale multi-component, multi-phase, multi-modal flow in porous media. These algorithms will encompass various techniques, including multilevel iterative solvers like multigrid and domain decomposition methods, as well as multiscale solvers such as multiscale finite element methods. Additionally, the efficient implementation of these algorithms on distributed computer systems is also expected.

Employment conditions:

The postdoc will be employed by King Abdullah University of Technology (www.KAUST.edu.sa) for one year, with the option of extension for one more year. The salary ranges between 50,000-65,000 USD per year (depending on background, experience, interview performance, etc.). Benefits include free housing, full medical insurance for whole family, free education for children studying in the KAUST School, and one-time relocation fee.

The postdoc will be working in a multi-disciplinary team headed by Prof. Jinchao Xu. For more information, contact Dr. Jongho Park (jongho.park@kaust.edu.sa).

Requirements:

- PhD in applied mathematics or engineering with specialization in numerical modelling
- Familiarity with an advanced simulation language
- Fluent in English