Matthew McLean – ITASCA Minneapolis

Geomechanics Engineer

Expertise

Reservoir Geomechanics, Geothermal Energy, Coupled Thermo-Hydro-Mechanical (THM) Modeling, Thermo-elasticity, Constitutive Modeling, Numerical Code Development

Education

Ph.D., 2024 – Petroleum Engineering
The University of Texas at Austin, Austin, Texas, USA

M.S., 2022 – Petroleum Engineering
The University of Texas at Austin, Austin, Texas, USA

B.S., 2020 – Geological Engineering, Summa Cum Laude
University of Mississippi, University, Mississippi, USA

Professional Affiliations

Member: American Rock Mechanics Association (ARMA)

Honors

Office of Science Graduate Student Research Program (SCGSR) Fellow (2023)

Outstanding Geological Engineering Student (2020)

Professional Experience

2024 – Present	ITASCA Minneapolis Geomechanics Engineer
2023 – 2024	Los Alamos National Laboratory, Energy and Natural Resources Security Group, Los Alamos, New Mexico Graduate Research Fellow
2023	Chevron Technical Center, Structure, Trap & Seal Group, Houston, Texas Earth Science Graduate Intern

Project Experience

Numerical Code Development for Forecasting Geothermal Energy Production: Developed finite element numerical models based on the theory of thermo-poroelastoplasticity for long-term prediction and forecasting of geothermal energy production in fractured geothermal reservoirs. Built coupling algorithms (one and two-way sequential methods) for fluid flow, heat transfer, and rock mechanical response. Applied effective medium methods to reservoir constitutive behavior, which accounts for the nonlinear, anisotropic, and plastic reservoir response. Utilized mechanical contact methods to model fluid flow, heat transfer, and associated mass/energy leak-off in hydraulic fractures. Applied distributed memory parallel programming libraries including MPI, METIS, and PETSc for numerical model scalability. Contributed freely available numerical codes to personal GitHub repository.

Constitutive Modeling: Applied nonlinear thermo-poroelastic behavior to fractured rock masses with compliant preexisting fractures, accounting for degradation of rock mass effective moduli in response to unloading and fracture reopening. Developed and applied elastoplastic return mapping algorithms for multi-surface plasticity (rock matrix and preexisting fracture sets).