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Life Impact  The University of Adelaide
Mining & Geotechnical Engineering Research - Key Capabilities

- Geostatistics & resource estimation
- Mine planning & optimisation
- Uncertainty assessment & stochastic modelling
- Geomechanics & stability assessment of rock excavations
- Rock fracture modelling
- Borehole stability assessment
Mineral Resources Estimation, Geostatistics, Computer-aided Mine Design

From drillhole data to...

... spatial modelling ...

... orebody modelling ...

... block modelling ...

... In-situ resource model ...

production optimisation, grade control, mine-mill reconciliation
Applications in Resource/Reserve Estimation of Unconventional Gas Reservoirs

Current Approaches:

- Volumetric method – $GIP \times RF$
- Decline curve analysis method
- Material-balanced method
- History matching method

Issues …

- Spatial variability not considered
- Uncertainty hard to quantify
- Many subjective assumptions

Application of spatial statistics for unconventional gas reservoir characterisation

A typical unconventional gas production curve
Stochastic Rock Fracture Modelling – Geothermal EGS

Seismic events of Habanero reservoir of Geodynamics’ EGS project in Cooper Basin, SA

Seismic events and three Habanero wells

Point density map
The methods developed


- RANSAC – a fracture model optimisation technique based on RANdom SAmpling Consensus (Younes et al. 2013)

- E-RANSAC – an extend RANSAC to take into account the time sequence of seismic events in the modelling process (Xu & Dowd, 2013)

- PANSAC – a method based on the Point ANd Surface Association Consensus, which can follow closely the time sequence of seismic events to optimise the fitted fracture propagation model (Xu & Dowd, 2013)
Final fracture propagation model for the Habanero reservoir

Generated by PANSAC
Use of the fracture model – Flow modelling

- Fluid flow and heat transfer through fractured rock mass
- Reservoir modelling, design and performance assessment
- Risk assessment of underground repository
- Reserve estimation

Connection paths and flow between H1 & H3
Pressure head during H1 & H3 circulation test
Applications in Unconventional Reservoir
Stochastic Rock Fracture Modelling

Connectivity Index – quantifying reservoir connectivity in a probabilistic measure
Flow through Porous and Fractured Rock

- Lattice Boltzmann Method (LBM)
- Simulating the Boltzmann equation
- Second-order approximation to the Navier-Stokes equation
Enhanced gas production by thermal treatment of the reservoir

- Thermal energy provided by underground gasification chambers.
- Numerical model shows 21% increase in production after thermal treatment.
Rock Permeability Measurement Facility – high pressure high temperature tri-axial cell

- In the process of setting up a high pressure, high temperature triaxial cell.
- Confinement pressure up to 150 MPa
- Temperature up to 300°C
- Core samples up to HQ size
- Supported by DVCR strategic funds, SACGER, ECMS, CEME
Borehole Stability Assessment in Fractured Rock and Unconsolidated Formations
Thank you