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Geomechanical Facies Concept In Fractured Resevoirs and the Application of Hybrid Numerical and Analytical Techniques for the Description of Coupled Transport In Fractured Systems

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Exploiting and geo-engineering of fractured rocks in the context of reservoir storage and utilisation is important to applications such as hydrogeology, petroleum geology, geothermal energy, nuclear waste storage and CO2-sequestration. Understanding fluid, mass and energy transport in the three dimensional fracture network is critical to the evaluation planned operating efficiency. Hydraulic, thermal, mechanical and chemical coupled processes under the typical reservoir conditions operate at different scales. Depending on whether the process is continuum dominated (e.g. transfer of stress in the rock body) or discontinuity dominated (e.g. hydraulic transport processes) different methods of numerically investigating and quantifying the system can be applied. A geomechanical facies approach provides the basis for large scale numerical analysis of the coupled processes and prediction of system response. It also provides the basis for a three dimensional holistic understanding of the reservoir systems and the appropriate investigation techniques which could be used to evaluate the capacities of the reservoirs to be investigated as well as appropriate development techniques. Concentrating on the numerical modelling there is often a difficult balance between the numerical stability criteria of the different equation systems which need to be solved to describe the interaction of the dominant processes. The introduction of analytical solutions where possible, functional dependencies and multiple meshes provides on the framework of the geo-mechanical facies concept provides an efficient and stable method for the prediction of the effect of the in situ coupling.