

March 17, At the Pore Scale Discussion Sessions

Mathematical Digital Rock Physics; is this the Future of SCAL? How Can We Apply High Resolution Rock Pore System Images Now?

Discussion Leader: Mark Knackstedt, Chief Technology Officer, Digital Core.

Raised questions/comments initially:

1. Can it duplicate SCAL experiments?
2. Need to plan a “good” experiment; as with conventional SCAL data, importance in sample choice, identifying key uncertainties, defining appropriate conditions (e.g, wettability), screening, rock typing, etc.
3. Need quality experiments to benchmark technology. Calibration with high quality laboratory data and direct 3D experimental imaging studies to modeled data.
4. Would we obtain similar results if we repeat experimental tests?
 - a. Both capillary pressure and relative permeability curves should be reconciled on sister plugs to ensure one obtains same answers or understands variability.
 - b. Good test parameters should be planned to achieve reliable and reproducible experimental results
5. What is the criteria in the benchmark process – measurement type, condition, rock type, etc
6. How can the new digital technology uncertainties be quantified/evaluated?
7. Where should digital rock physics technology be applied first?
8. What does it measure that has been bench marked?
9. How much data is required?
10. How many validation studies are required?
11. How to upscale the data?
12. Can it help improve compromised or historic data?
13. Which one is of most value: validation, uncertainty evaluation (explaining scatter) or the development of pore scale understanding?
14. Is digital analysis a replacement for core analysis or an augmentation?

Where can the digital rock physics technology be applied now:

- Shale/Tight Gas/Coal/Fractured Basement Rock where there is no reliable alternative
- Where early data is required (accelerated development)
- When there are no alternatives
 - where there is no Representative Element Volume (REV)

- understanding pore systems (decoupling contributions from pore types and pore sizes)
- Elastic properties
- Tensorial properties
- Gas hydrate
- Scanning hysteresis curves
- Heavy oil
- Cuttings/damaged core
- Scenario testing

What is needed:

- Multi-scale analysis
- Benchmarking (MICP, K, Porosity, pore scale mechanisms, P_c , K_r , V_p , V_s)
- Illustrating value obtained at the smallest scale.
- Database Management, Inspection and interrogation Up-scaling:
 - First pore to plug scale
 - Next plug to Log Scale—
 - then to larger scale

Goal (partial discussion)

Constrain data so less degree of freedom is given in reservoir modeling