**Robust Production Optimization (RO)**: To optimize production with the consideration of uncertainties.

**Motivation**: RO requires a very large number of reservoir simulations, and it can be very computationally expensive to use grid based reservoir models for RO. Thus, a proxy model is required to reduce computational cost for RO.

**Basic Requirements of a Proxy Model**:
1) able to capture the most important physics and mechanisms affecting production prediction;
2) very computational attractive.

**Main Contributions**:
1) a general workflow of using a proxy model for fast RO;
2) illustration of the use of a Capacitance-Resistance Model (CRM) as a proxy model in the new workflow.

**Capacitance-Resistance Model (CRM)**:
- a material balance based model and derived from total fluid continuity equation (and saturation equation).
- few model parameters. Two most important ones are
  - Connectivity: describes the fraction of water injected by an injector that contributes to the total production of a producer;
  - Time Constants: a characteristic time for the pressure wave to travel from an injector to a producer.
- reduces a grid based model to a two-point (injector-to-producer) model (Fig. 2).

**Result**:
- For matching, the CRM matches the pseudo production history (total production rates and water cuts) very well (Fig. 3).
- For validation, the productions predicted by the CRM are very similar to that by the grid based model (Fig. 4).
- The optimal injection scheme of the new and traditional workflows are different (Fig. 5).
- After RO, the eNPV is improved significantly. The optimal eNPV of the new workflow is only 0.65% lower than that of the traditional workflow whilst the computational cost is reduced by 12 times (Table 1).

**Implementation**:
- Grid Based Model: 2D model with 4 injectors and 1 producer (Fig. 2), oil and water phases.
- CRM Based Model: Coupled CRMP.
- Control: Water injection rate.
- Objective: To maximize expected Net Present Value (eNPV).
- Ensemble Size: 100 realizations.

**Main Conclusion**:
The CRM is a potential candidate to be a proxy model as the result shows that it significantly speeds up the robust production optimization whilst still giving robust result.

**Further Works**:
More advanced applications of the CRM – using the CRM for fast robust closed-loop reservoir management⁴ and for assessing the value of information for history matching⁵.

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