GEOMECHANICAL MODELING OF HYDROCARBON RESERVOIRS: STATE OF THE ART

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Most of the conventional geomechanical models used by the oilfield industry are restricted to single-well or near-well analysis. Examples of this type of models are the ones used to predict wellbore stability while drilling or to design wellbore completions (cementing, hydraulic fracturing, sand control), which have been around for decades. The current trend is to build numerical models that include entire hydrocarbon reservoirs, with the aim of predicting the response of the rock and structures (either in the reservoir or in the overburden or side burdens) to the changes of pore pressure induced by production and/or injection. This type of model is rapidly becoming a new standard in the industry, and requires the use of numerical methods (usually finite element of finite difference) with large number of elements (in the order of millions). These models must include non-linear constitutive laws that can represent the elasto-plastic or visco-elasto-plastic behavior or rock, faults and evaporites, and to account for the coupling with pore pressure and temperature changes. The construction of these models also require the integration of many sources of data at very different scales, including seismic velocity volumes, well logs, laboratory data and in-situ measurements of pore pressure and stresses, both for determination of the rock properties and for calibration of the models. In this presentation, we will illustrate the current workflow that we use in Schlumberger Data & Consulting Services to build this type of models, showing also how the results are applied by oilfield operators for making decisions on well placement, completion methods and overall production strategy, with examples from some real projects carried out in the last 3 years.

Bio: Dr. José Adachi is a Principal Geomechanics Specialist at Schlumberger Data & Consulting Services (Houston) since 2006, where he works as a reservoir and completion geomechanics consultant for oil and gas companies. From 2002 and 2006, he worked in the development of hydraulic fracturing numerical models at the Schlumberger Engineering Applications Dept. in Sugar Land, TX. He obtained his M.S. and Ph.D. in Geological Engineering at the University of Minnesota in 1996 and 2001, respectively, and his B.S. in Mining Engineering at the Catholic University of Lima, Peru.