**https://www.spe.org/events/en/2021/conference/21rsc/call-for-papers.html**

**Abstract Information**

Please notes that Abstract submissions should be formatted into four (4) specific paragraphs:

* Objectives/Scope: Please list the objectives and/or scope of the proposed paper. (25-75 words)
* Methods, Procedures, Process: Briefly explain your overall approach, including your methods, procedures and process. (75-100 words)
* Results, Observations, Conclusions: Please describe the results, observations and conclusions of the proposed paper. (100-200 words)
* Novel/Additive Information: Please explain how this paper will present novel (new) or additive information to the existing body of literature that can be of benefit to and/or add to the state of knowledge in the petroleum industry. (25-75 words

**Title:** An Unstructured Algebraic Multiscale Solver for the Simulation of Two-Phase Flows in Heterogeneous and Anisotorpic Porous Media

**Objectives/Scope:** We introduce a new multiscale finite volume framework for the simulation of multi-phase flow in heterogenous and anisotropic porous media on quite general unstructured grids that enable geophysical grid defined properties to be used directly.

**Methods, Procedures, Process:** A novel pre-grid strategy is presented, where an auxiliary mesh is used to assist the creation of multiscale primal and dual coarse grids. Due to the unstructured grid connectivity, the resulting dual grids do not retain the natural uncoupling associated to the use of structured grids. This may lead to errors in the computation of the basis function, what in turn, contributes to the loss of mass conservation. A generalization of the Algebraic Multiscale Solver (AMS) is proposed to deal with this problem and to prevent the basis function induced “leakage” outside its support region . This enables the coupling with a Control Volume Distributed MultiPoint Approximation (CVD-MPFA), ensuring the method is consistent on unstructured grids with non k-orthogonal permeability tensors.

**Results, Observations, Conclusions:** We present three different problems in which we validate the accuracy of the framework by comparing the multiscale solver with direct simulation on the fine-scale. The results obtained show that the method can produce well resolved solutions for two-phase flow in highly heterogenous and anisotropic porous media using general unstructured grids on all considered scales. As a consequence, the method captures the most important flow features that result on high-resolution geophysical models while providing suitable discretizations for complex geological formations found in current petroleum reservoir problems.

**Novel/Additive Information:** The novelty of this scheme involves three components which combine to enable consistent multiscale simulation on unstructured grids: i) a new approach to primal and dual coarse grid generation, ii) a novel technique to restrain basis function induced leakage and iii) for the first time the coupling of the Algebraic Multiscale Solver (AMS) with a Multipoint Flux approximation with a Diamond Stencil (MPFA-D).