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An implicit control-volume finite element method for well-reservoir modelling[1] DIMITRIOS PAVLIDIS, PABLO SALINAS, ZHIHUA XIE, CHRISTOPHER PAIN, OMAR MATAR, Imperial College London — Here a novel implicit approach (embodied within the IC-Ferst) is presented for modelling wells with potentially a large number of laterals within reservoirs. IC-Ferst is a conservative and consistent, control-volume finite element method (CV-FEM) model and fully unstructured/geology conforming meshes with anisotropic mesh adaptivity. As far as the wells are concerned, a multi-phase/multi-well approach, where well systems are represented as phases, is taken here. Phase volume fraction conservation equations are solved for in both the reservoir and the wells, in addition, the field within wells is also solved for. A second novel aspect of the work is the combination of modelling and resolving of the motherbore and laterals. In this case wells do not have to be explicitly discretised in space. This combination proves to be accurate (in many situations) as well as computationally efficient. The method is applied to a number of multi-phase reservoir problems in order to gain an insight into the effectiveness, in terms of production rate, of perforated laterals. Model results are compared with semi-analytical solutions for simple cases and industry-standard codes for more complicated cases.

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