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METHOD OF MULTISCALE VIRTUAL POWER APPLIED TO AN RVE COMPOSED OF A SATURATED POROUS MEDIUM MATRIX AND SOLID INCLUSIONS

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Abstract. In this work, a multi-scale model based on the concept of the Representative Volume Element (RVE) is proposed, whose particularity is that it is composed of a saturated porous matrix with solid impermeable inclusions. For the former it is accepted to describe their behaviour by the general theory of poromechanics, requiring micro-displacements and micro-pore pressures fields for their description, while the latter can be assessed by applying solid mechanics theory, which demands only the micro-displacements field for their analysis. This particular heterogeneity of the RVE implies proper treatment of the transition between the scales, which is achieved with appropriate definitions of insertion (macro-to-micro) and homogenization (micro-to-macro) operators, which guarantee a physically meaningful transfer of the relevant variables. In turn, this provides suitable admissible constraints on primal variables fields. On the other hand, the macro-scale assumes a poromechanical behavior, as it is done for the matrix at the micro-scale, being finally that the physics between both scales can be linked in terms of virtual power measurements provided by the same porous media approach. Eventually, it is possible to apply the so-called Principle of Multiscale Virtual Power, together with the derived admissible constraints on micro-scale, that yields a well-established variational framework. This setting allows deriving the micro-scale balance equations as well as the homogenization relations for the macro-scale stress-like variables and body forces.