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IDENTIFICATION OF LOW-CONTRAST INCLUSIONS IN POROELASTIC MATERIALS

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This contribution is devoted to the determination of subsurface images for the identification of solid inclusions in poroelastic media, which is important in applications as diverse as hydrology, mining processes, biological tissues, among many others. To this end, the Biot's model is considered for a fully saturated poroelastic medium in time harmonic regime, where the location and shape of several inclusions can be detected by applying recent developments for shape optimization problems, more precisely, the small amplitude homogenization method [1, 2, 3]. Using partial boundary and/or interior data, regions having different elastic parameters than that of the skeleton (or matrix) can be recovered by minimizing the misfit between the measured data from an array of receivers and that given by numerical guesses.

By assuming that the contrast between the two possible values for the parameters is not very large, the construction of the minimizing sequence is performed by an asymptotic approximation, made up to second order with respect to the contrast parameter. Hence, a cascade of equations is obtained and the limit equations are established through a relaxation process, allowing then mixtures zones. Once this procedure is achieved, the evaluation of a steepest descent method becomes a simple matter. One remarkable difficulty for obtaining the limit equations, is the appereance of products of weakly convergent sequences, whose limit and respective correction terms are obtained via H-measures [4].

Finally, numerical results will be shown to demonstrate the performance and reliability of this method.

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