DISCONTINUOUS GALERKIN METHODS WITH PLANE WAVES FOR THE BIOT THEORY

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We are interested in the development of a Discontinuous Galerkin Method (DGM) for sound absorbing materials. These materials are commonly used for noise and vibration control. The objective of this method is to discretize the structure and to represent in each element the field as a superposition of local solutions such as plane waves. This type of methods have shown their efficiency by requiring much smaller numbers of degrees of freedom compared to standard polynomial interpolations (i.e. FEM) especially when the frequency is increased. For poroelastic materials, the solutions are expressed in terms of Biot waves (two of them associated to compression waves and one corresponding to shear waves). The poroelastic problem is expressed as a first order model and the formulation of numerical flux at interfaces between elements is derived and implemented. Compared to classical DG methods for standard acoustics, this method is applied here to a dissipative medium and to a two-displacement field involving shear and compression waves. Several two-dimensional cases will be presented in order to validate the method and to compare against analytical and Finite-Element solutions (in displacement and mixed formulation). Results will be discussed in terms of accuracy of the method, errors and conditioning of the linear systems. A dispersion analysis of the scheme will be presented and the method is compared to classical Finite-Elements.