A boundary integral method for poroelasticity

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Wave propagation in porous media is an important topic, e.g. in geomechanics or the oil-industry. We formulate a linear system of coupled partial differential equations based on Biot's theory with the solid displacements and the pore pressure as the primary unknowns. To solve this system of coupled partial differential equations in a semi-infinite homogeneous domain the BEM (Boundary element method) is especially suitable. Starting from a representation formula a system of two boundary integral equations is derived. These boundary integral equations are used to solve related boundary value problems via a direct approach. Coercivity of the resulting bilinear form is shown, from which unique solvability of the variational formulation follows from injectivity. Using these results we derive the unique solvability of the related boundary integral equations. Furthermore appropriate time and space discretizations are applied to solve the system of boundary integral equations. Suitable stable schemes are derived and error estimates are presented.