

Weak Solutions for an Implicit, Degenerate Poro-elastic Plate System

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We consider a recent plate model obtained as a scaled limit of the three dimensional quasi-static Biot system of poro-elasticity. The result is a “2.5” dimensional linear system that couples traditional Euler-Bernoulli plate dynamics to a pressure equation in three dimensions, where diffusion acts only transversely. Motivated by application, we allow the permeability function to be time-dependent, making the problem non-autonomous and disqualifying much of the standard theory. Weak solutions are defined and the problem is framed abstractly as an implicit, degenerate evolution problem:

$$[Bp]_t + A(t)p = S.$$

Existence is obtained, and uniqueness follows under additional hypotheses on the temporal regularity of the permeability. Time permitting, we address the inertial case with constant permeability by way of semigroup theory.