A rigorous derivation of the equations for the clamped Biot-Kirchhoff-Love poroelastic plate*

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In this talk we present results on the limit behavior of the solution to quasi-static Biot's equations in thin poroelastic plates as the thickness tends to zero. We choose Terzaghi's time corresponding to the plate thickness and obtain the strong convergence of the three-dimensional solid displacement, fluid pressure and total poroelastic stress to the solution of the new class of plate equations. In the new equations the in-plane stretching is described by the 2D Navier's linear elasticity equations, with elastic moduli depending on Gassmann's and Biot's coefficients. The bending equation is coupled with the pressure equation and it contains the bending moment due to the variation in pore pressure across the plate thickness. The pressure equation is parabolic only in the vertical direction. As additional terms it contains the time derivative of the in-plane Laplacian of the vertical deflection of the plate and of the the elastic in-plane compression term.

References

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