# COMPUTATION OF SAND FLUIDIZATION PHENOMENA COUPLED WITH GEOMECHANICS USING STABILIZED FINITE ELEMENTS

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Sand fluidization is an inevitable phenomenon that occurs in weakly consolidated porous medium when a fluid saturated sand body loses its mechanical integrity under sharp fluid pressure drawdown and in-situ stress changes. We present a coupled erosion-geomechanics model within mixture theory in which solid, fluid, and fluidized sand phases interact through key factors such as porosity, fluid sand concentration, fluid pressure and deformation of sand body in mass balance and equilibrium equations. The detachment of sand particles is introduced by a sink term in the mass balance equations via a simple erosion law. Due to the nature of resulting convection dominated equations, numerical solutions afforded by conventional Galerkin's finite element schemes become unstable, and are corrupted with wiggles that eventually blow up when the governing field gradient becomes very large. Consequently, an optimized local mean technique is proposed to eliminate the oscillations by expanding the local field variables such as density, pressure, and stress into a Taylor series in a finite size domain to account for the effects of curvature induced by sharp local changes. As such, the original form of the governing equations describing the physics of the problem is preserved, while additional terms leading to numerical stabilization naturally emerge during the numerical process. Thus, a fundamental explanation of the ad-hoc terms commonly used in stabilized numerical methods (i.e. Streamline Upwind/Petrov-Galerkin method) can be given. Finally, we present numerical solutions pertaining to sand fluidization that are free of oscillations.