GOVERNING EQUATION

Mathematical description of a deforming slurry can be presented in either Lagrangian or Eulerian coordinate systems. In the Lagrangian formulation the changes are observed in the vicinity of a particle, while in the Eulerian formulation the changes in a fixed element in space are observed. Hence, the Lagrangian formulation is sometimes referred to as the material formulation while the Eulerian formulation is referred to as the spatial formulation. In the Lagrangian formulation the particle position could be referred to its initial location or to the location of the particle in a coordinate system in which the actual distances are reduced to the distances in terms of solids distances (no voids). In the latter case the coordinate system is referred to as a "reduced" coordinate system.

For one dimensional description of a settling slurry the relationship between the Eulerian and reduced Lagrangian coordinates is depicted in Fig. 1, in which ξ is the spatial coordinate while λ is the reduced material coordinate.

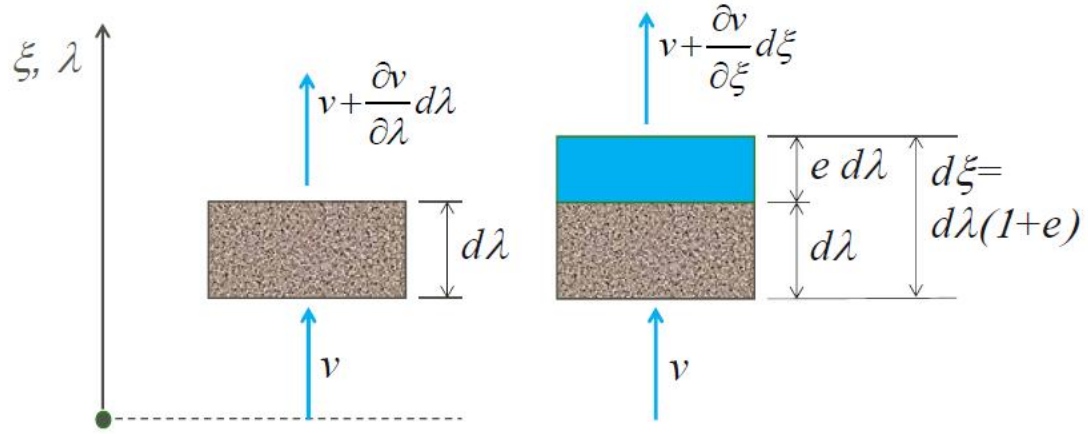

Figure 1 – Relations between spatial coordinate ξ and reduced material coordinate λ

Gibson et al. (1967) derived the following equation describing the large-strain consolidation process:

$$\left(\frac{\gamma_s}{\gamma_w}-1\right)\frac{\partial}{\partial\lambda}\left(\frac{k}{1+e}\right)-\frac{\partial}{\partial\lambda}\left(\frac{k}{\gamma_w}\frac{1}{1+e}\frac{\partial\sigma'}{\partial e}\frac{\partial e}{\partial\lambda}\right)=\dot{e} \qquad (1)$$

Where

γ_s = unit weight of solids

γ_w = unit weight of water

e = void ratio

k = hydraulic conductivity

σ' = effective stress