

# The theory for describing Various phenoma on Various Soils



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Construction



Pollution



Energy



Space development



Drought



Conceptual figure of soils in Geotechnical Eng. Geophant (Mikasa, 1978)



Freezing



Heavy rain



Earthquake



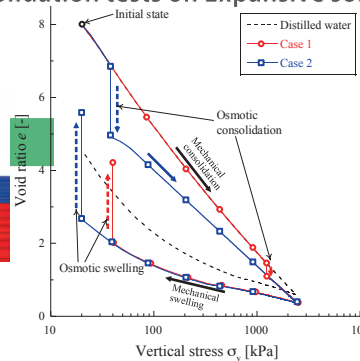
Tsunami



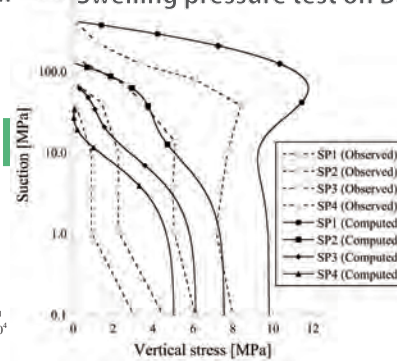
Flood

## describing by theory

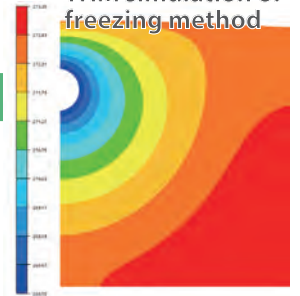
Osmotic consolidation tests on Expansive soil



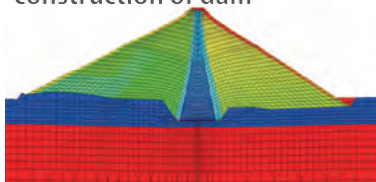
Swelling pressure test on Bentonite



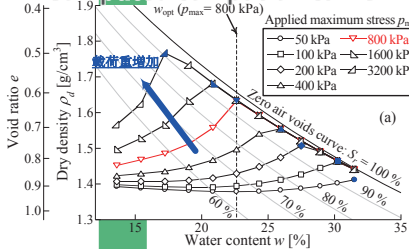
THM simulation of freezing method



HM simulation of construction of dam



Computed compaction curve



## Element test Formulation Simulation



$$\delta \sigma_{ij} (\sigma_{ij}, \epsilon_{ij}, p_w, p_a, T, c, \dots)$$

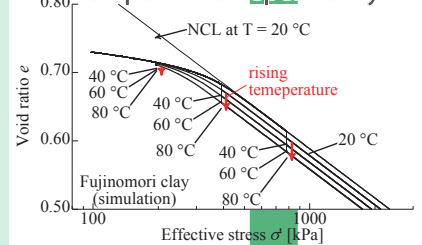
$$\frac{\partial \sigma_{ij}}{\partial x_j} + p \delta_{ij} = 0$$

$$\frac{\partial v_i}{\partial x_i} + \frac{1}{p_s} \frac{\partial p^u w_i}{\partial x_i} = 0$$

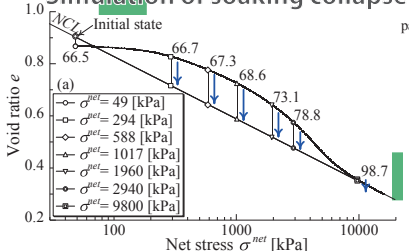
$$\frac{DT}{Dt} + w_i \frac{\partial T}{\partial x_i} = -\delta q_i$$



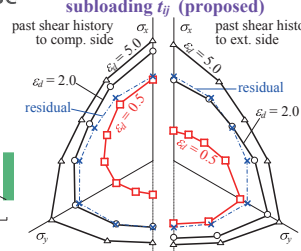
Temperature dependency



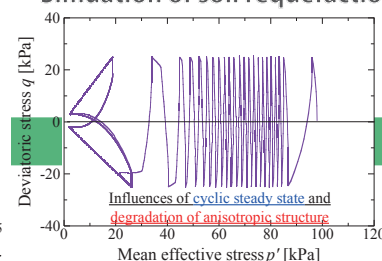
Simulation of soaking collapse



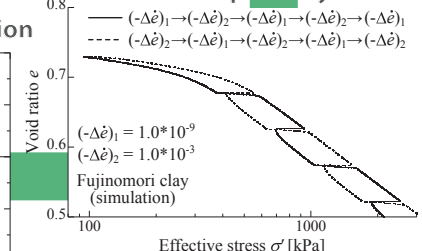
subloading  $f_{ij}^*$  (proposed)



Simulation of soil requefaction



Strain rate dependency



Stress state and history dependency  $\frac{q}{p'}$