Data Assimilation for Geotechnical Applications

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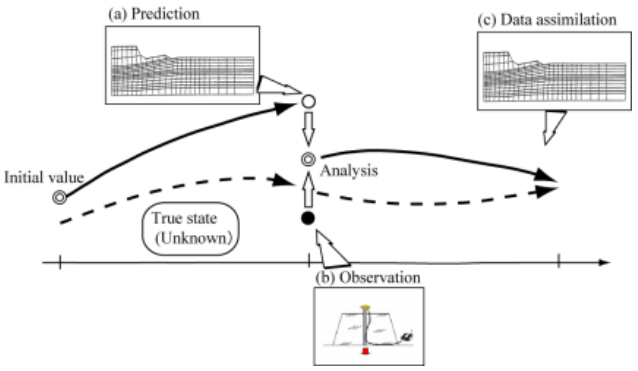
A computational method, incorporating the finite element model into data assimilation using the particle filter, is presented for identifying material properties based on sequential measurements under the known changing traction boundary conditions in order to overcome some difficulties in identifying the parameters for elasto-plastic problems from which the existing inverse analysis strategies have suffered. A soil-water coupled problem, which uses the elasto-plastic constitutive model, is dealt with as the geotechnical application. Measured data on the settlement and the pore pressure are obtained from a synthetic FEM computation as the forward problem under the known parameters to be identified for both the element tests and the ground behavior during the embankment construction sequence. Parameter identification for elasto-plastic problems, such as soil behavior, should be made by considering the measurements of deformation and/or pore pressure step by step from the initial stage of construction and throughout the deformation history under the changing traction boundary conditions due to the embankment or the excavation, because the ground behavior is highly dependent on the loading history. Thus, it appears that sequential data assimilation techniques, such as the particle filter, are the preferable tools that can provide estimates of the state variables, i.e., deformation, pore pressure, and unknown parameters, for the constitutive model in geotechnical practice. The presentation focuses on the priority of the particle filter in its application to initial/boundary value problems for elasto-plastic materials and demonstrates a couple of numerical examples.



Guests are welcome!