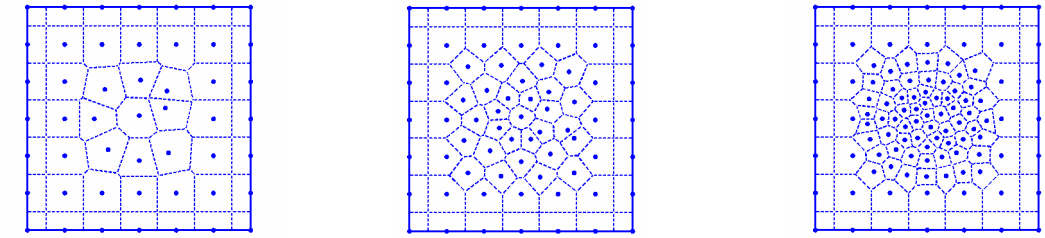
Adaptive Multiple-Scale Meshfree Method for Geo-Mechanics and Earth-Moving Simulation

Sponsor: National Science Foundation (J. S. Chen)

Objectives

The objective of the proposed research is to develop a practical simulation method capable of predicting large deformation, shear-band formation, damage evolution, and material separation in geotechnical materials with applications to earth-moving processes. Special emphasis will be given to the development of an adaptive multiple-scale meshfree method that allows an interactive and continuous model refinement in the simulation of soil motion. The local shear-band and damage mechanisms are critical to overall soil motion in earth moving processes. The ultimate goal is to capture the fine-scale local shear-band and shear/tensile failure mechanisms embedded in the overall soil response. A collaboration with Caterpillar will enable research effort on experimental validation of the employed constitutive model and meshfree methods.

Progress Summary



(a) Voronoi diagram of level_1 model

(b) Voronoi diagram of level_2 model

(c) Voronoi diagram of level_3 model

Figure 1 Adaptive Refinement based on Voronoi Diagram

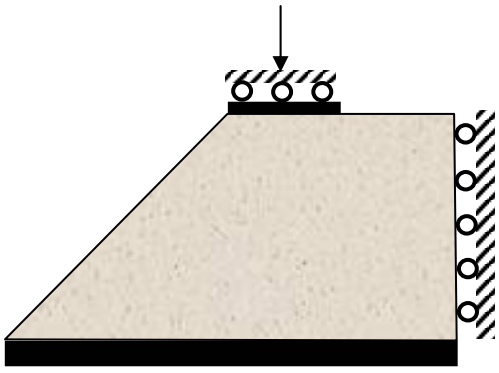


Figure 2 Slope Subjected to Footing Load

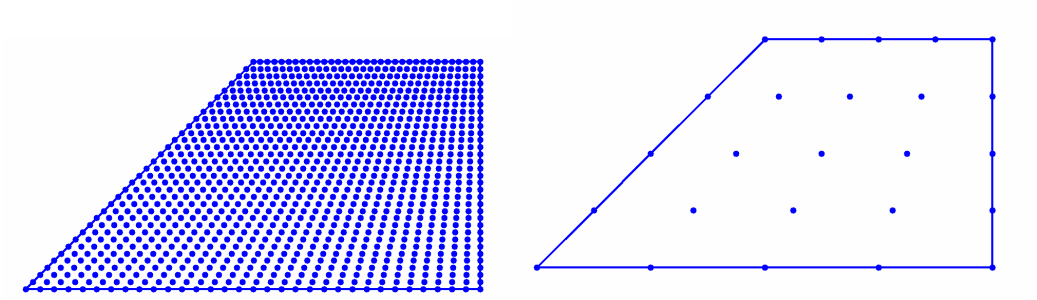


Figure 3 Uniform Refinement

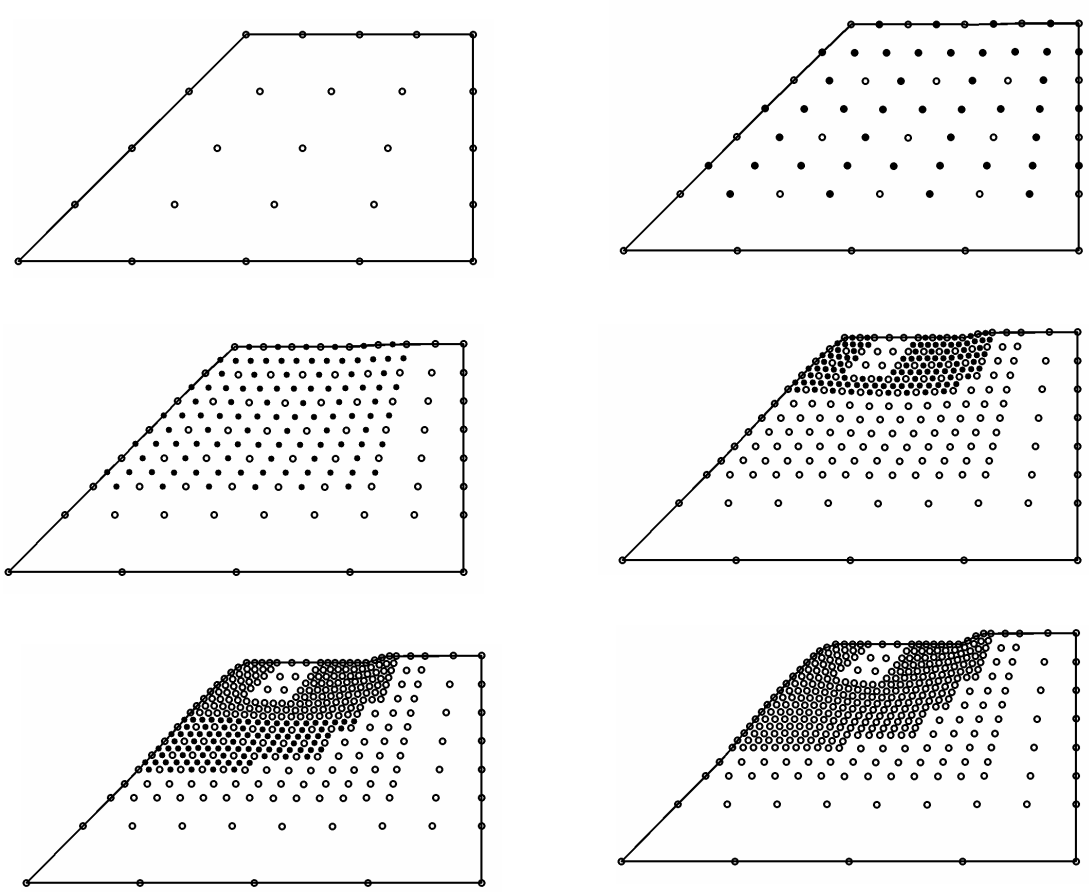
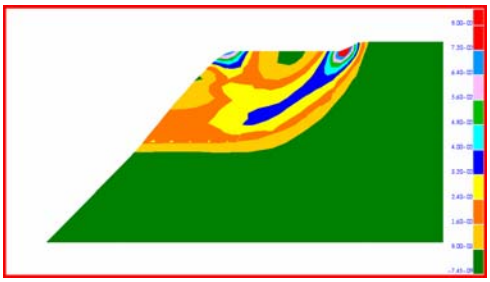
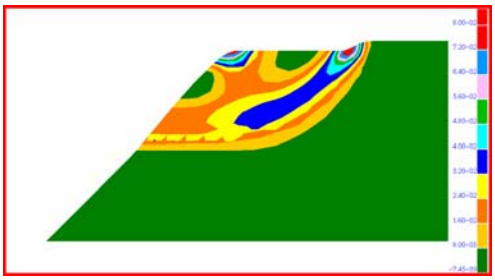


Figure 4. Adaptive Refinement



(a) Fixed Coarse Model

(b) Fixed Fine Model



(c) Adaptive Refinement Model

Figure 5 Comparison of effective plastic strain for different models

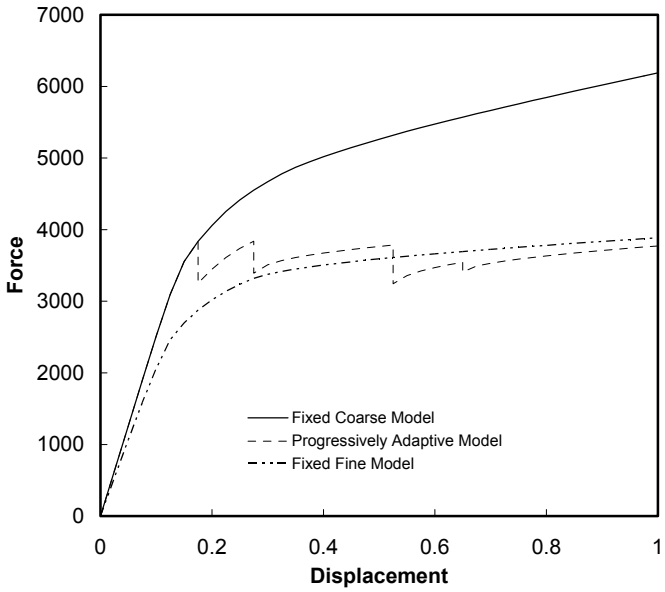


Figure 6 Comparison of deflection-force curves for different models