

MESHLESS METHOD FOR NONLINEAR MATERIALS

Codes Developed

- **MfreePim** Point interpolation method (PIM) with radial basis for foundation engineering
- **Mfreenon** Nonlinear analysis for geomaterials

Application

Non-linear analysis for mechanical and foundation engineering

Meshless technologies in solid mechanics are very active under developments in the world. Its fundamental concept is that any explicit mesh is replaced by node selection techniques. This replacement can avoid many problems associated with mesh-based techniques such as FEM and FDM and is of many benefits. This project has studied interpolation methods such as PIM with polynomial or radial function bases and MLS over a cluster of selected scattered nodes. Fig.1 shows the smoothing transition in overlapping zone for radial function. The applications of MfreePim in foundation and tunnel interaction are shown in Fig. 2. The nonlinear properties of geomaterials are studied in small deformation. An improved auto-step scheme is proposed to simulate construction procedures in foundation engineering. As an example, the evolution of stress level under a strip load is shown in Fig.3 for a foundation problem. A variety of constitutive models are being incorporated into the Mfreenon package.

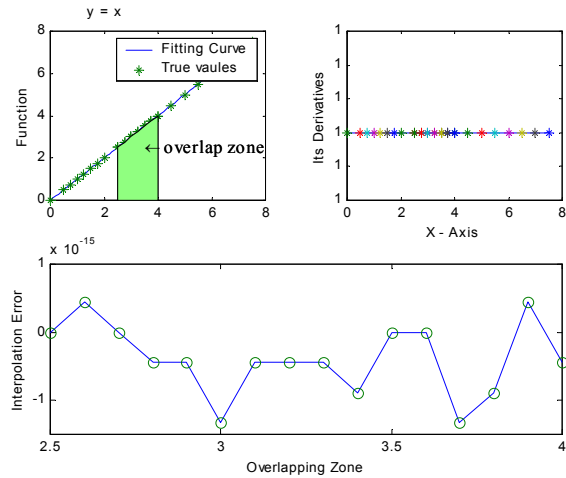
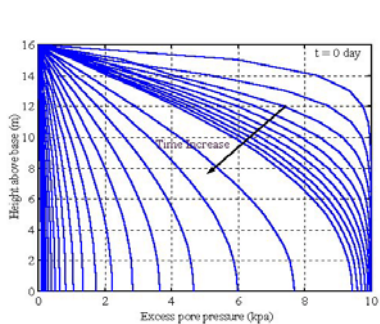
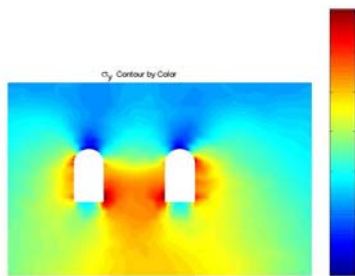


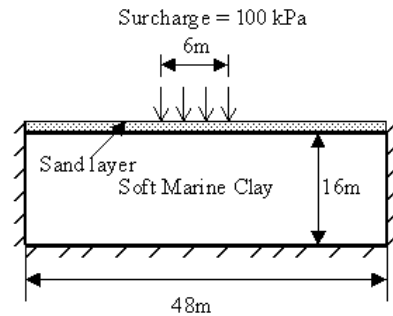
Fig.1 Connectivity in overlapping zone of compact support for linear function ($y=x$), the function and its derivatives are exactly represented by radial approximation (exactly refers to precision better than 10^{-14} .)



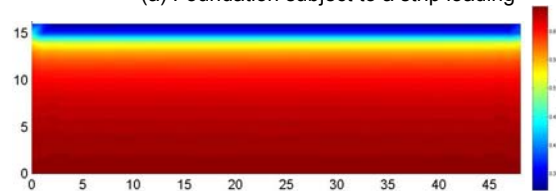
(a) Dissipation of pore pressure for one-dimensional consolidation



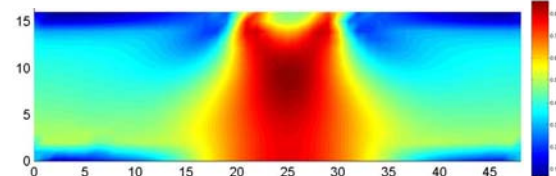
(b) Stress σ_v in Interaction of tunnels



(a) Foundation subject to a strip loading



(b) Stress level under self-weight only



(c) Stress level under self-weight and strip load

Fig.2 Application of MfreePim In Foundation Engineering

Fig.3 Evolution of stress level for nonlinear foundation (by Mfreenon)