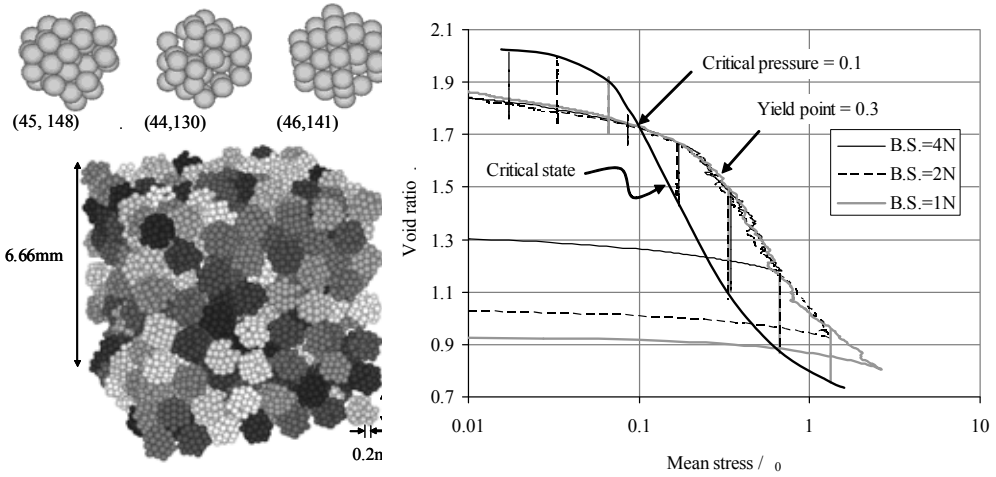
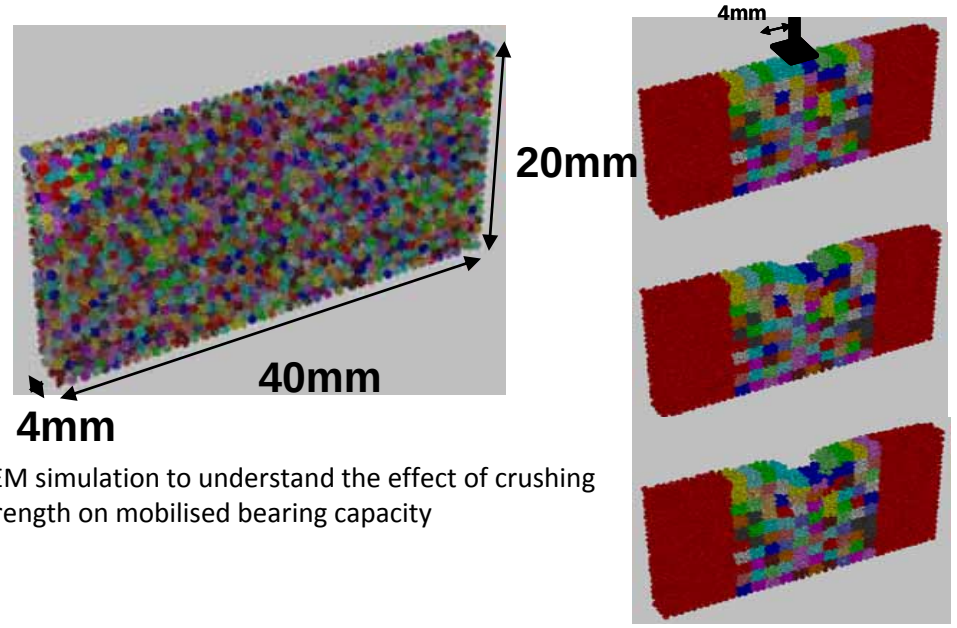
Name：Yukio NAKATA
Affiliation：Yamaguchi University

Research theme : GEO-MECHANICS OF CRUSHABLE SOIL FROM MICRO TO MACRO

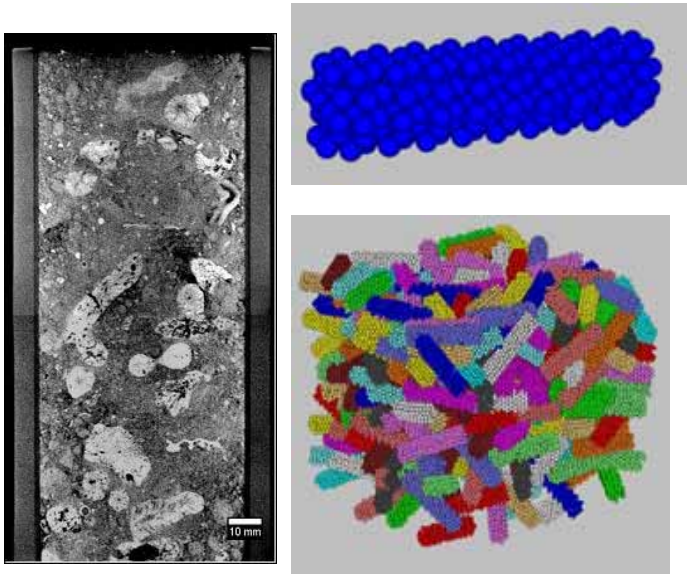
OBJECTIVE: Grain properties, grain crushing behaviour in granular material, compression and dilatancy behaviour depending on pressre, bearing capacities and slope stability



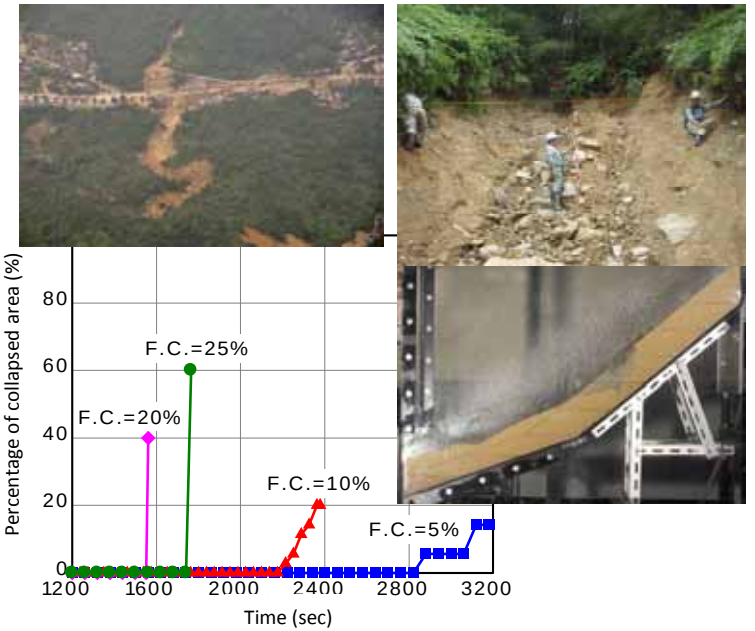
Effects of crushing strength on mechanical behaviour



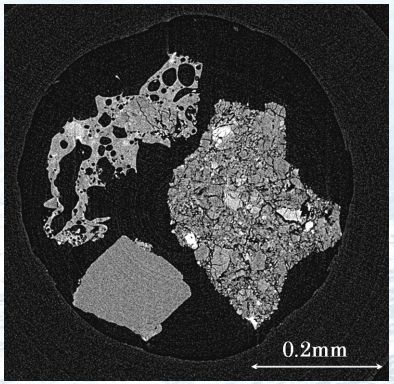
DEM simulation to understand the effect of crushing strength on mobilised bearing capacity

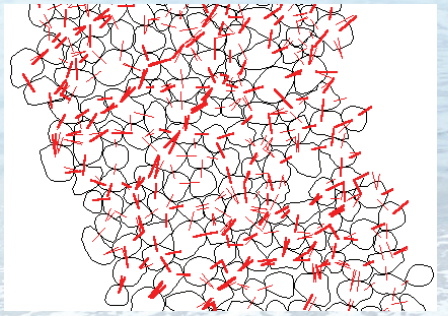


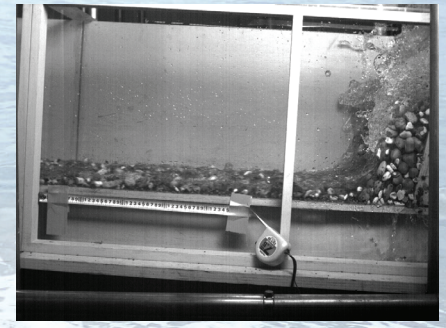
Effects of coral gravels on the mechanical behaviour

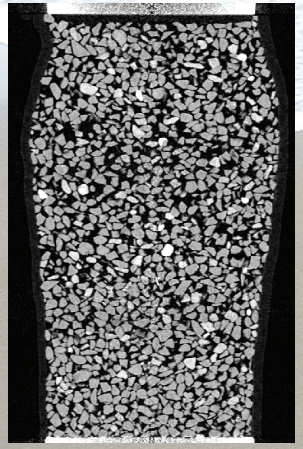


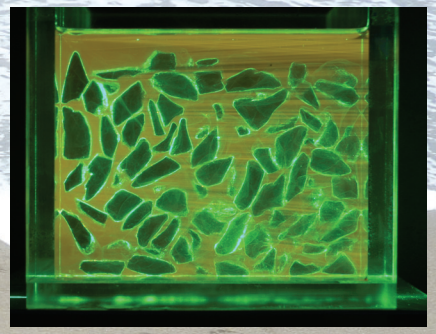
Effects of fine grain content on slope stability due to rainfall











Granular mechanics for science, engineering, and curiosity!

Matsushima, T., Katagiri, J., Uesugi, K., Tsuchiyama, A., Nakano, T.: 3-D Shape Characterization and Image-based DEM simulation of Lunar soil simulant, FJS-1, Journal of Aerospace Engineering, ASCE, 22,1,pp.15-23, 2009.1.

Katagiri, J., Matsushima, T., Yamada, Y.: Simple shear simulation of 3D irregularly-shaped particles by image-based DEM, Granular Matter, 12, 5, 491-497, 2010.

Matsushima, T., Chang, C.S.: Quantitative evaluation of the effect of irregularly shaped particles in sheared granular assemblies, Granular Matter, 13:269–276, 2011

Tsuchiyama, A., Uesugi, M., Matsushima, T., et al. : Three-Dimensional Structure of Hayabusa Samples: Origin and Evolution of Itokawa Regolith, Science 333, 1125, 2011 (DOI: 10.1126/science.1207807))

Ueda, T., Matsushima, T., Yamada, Y: Effect of particle size ratio and volume fraction on shear strength of binary granular mixture, Granular Matter, 13:731–742, 2011

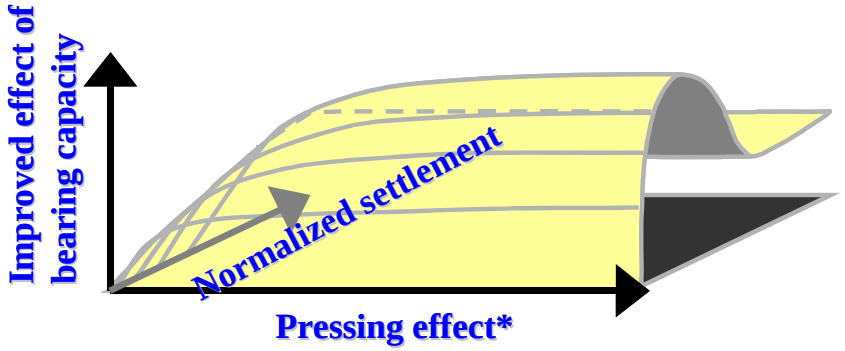
Ueda, T., Matsushima, T., Yamada, Y.: Micro structures of granular materials with various grain size distributions, Powder Technology, 217, 533-539, 2012.02.

http://www.kz.tsukuba.ac.jp/~tmatsu/

Name：Noriyuki Yasufuku
Affiliation：Kyushu University, Faculty of Engineering

Development of high-performed pile foundation and its evaluation

/Objective: *To Develop a rational pile type with rotational and taper shaped functions to minimize the environmental impact and its evaluation method as a limit state design.*



***:Rate of soils pressed to the volume of pile**

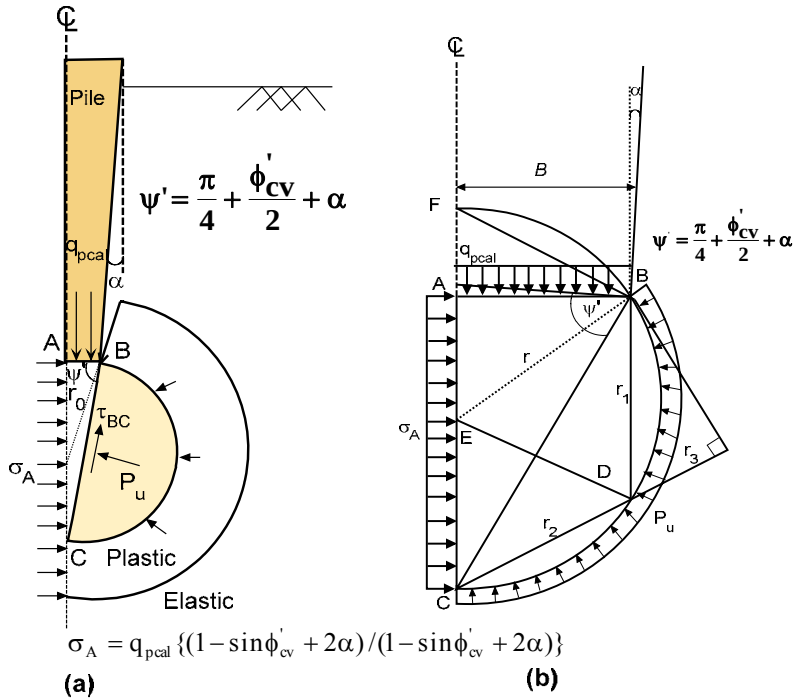
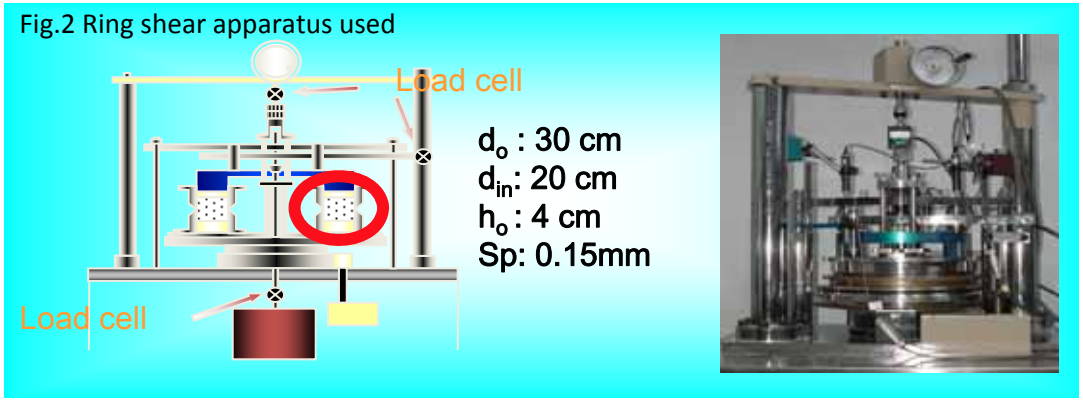


Fig. 1 (a) Concept of modified failure mechanism around the tapered pile tip in cavity expansion solution and (b) Geometry of calculation procedure to find ultimate end bearing capacity of tapered pile.

Sand-steel interface friction over a wide shear deformation concerning to soil crushability

/Objective: *To make clear the Sand –steel Interaction properties at peak and residual (large deformation) states and to reflect the results into a limit state design methodology of pile foundation*

Fig.2 Ring shear apparatus used



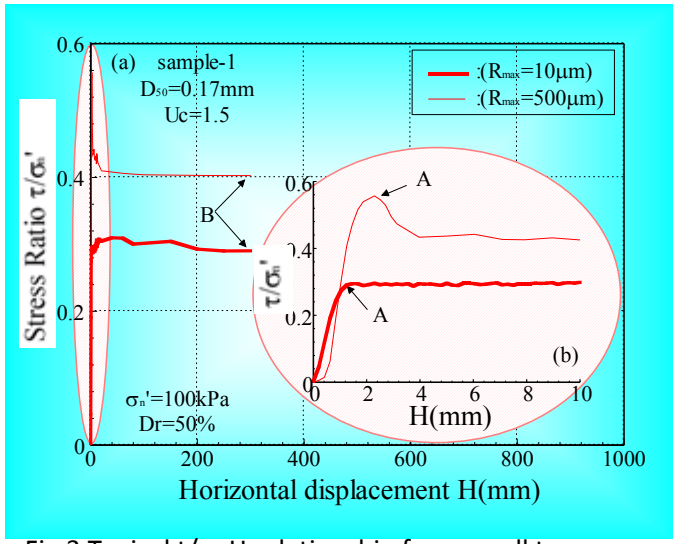
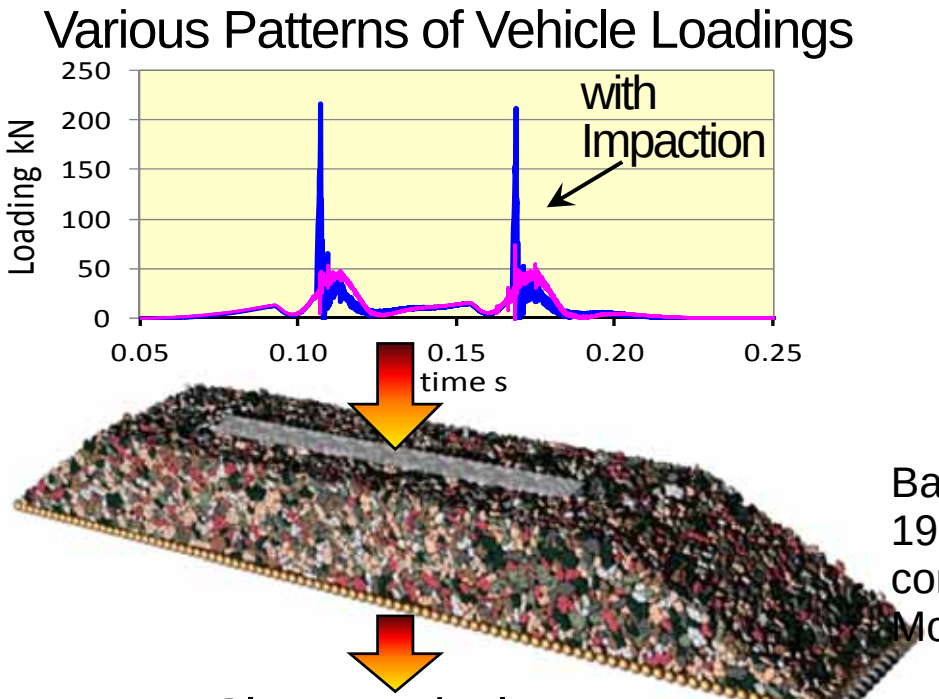


Fig.3 Typical t/s_n-H relationship from small to large deformation and definition of d

Name：A. Kono
Affiliation：Railway Technical Research Institute --- collaborative research with Tsukuba University

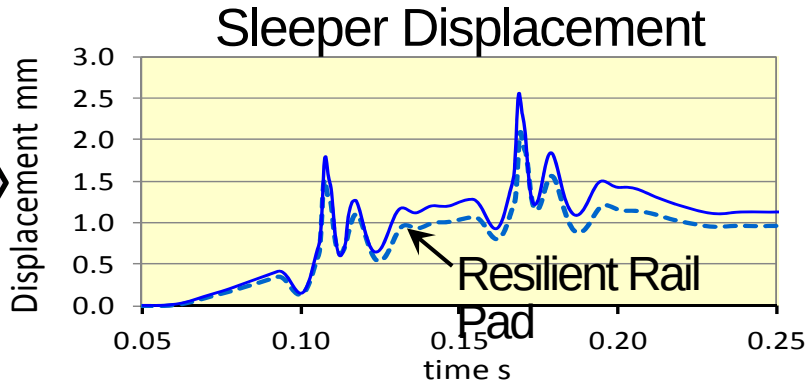
Mission1 : Finding out the most effective factor causing problems.
Mission2 : Proposing some reducing methods for the factor.



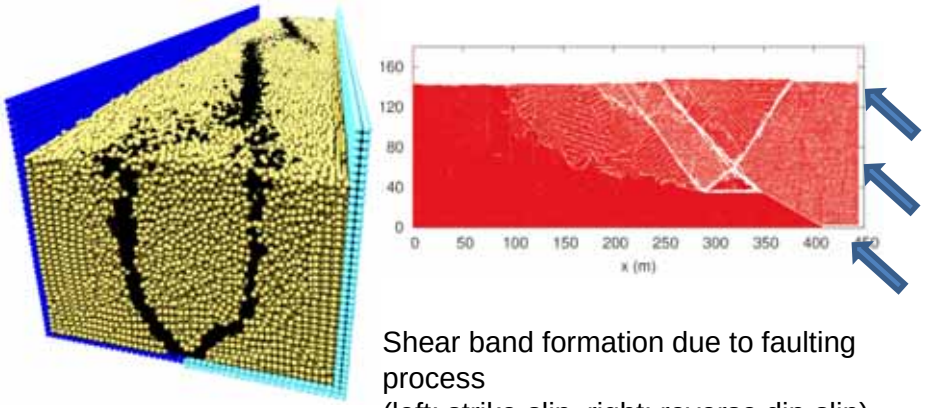
Differential Settlement,
Abraded Grains,
Ballast Flow, and so on.

Ballasted Track Model with
19044 Ballast Grain Elements
composed of Clumped-Spheres
Model.

Replacing
Resilient
Rail Pad

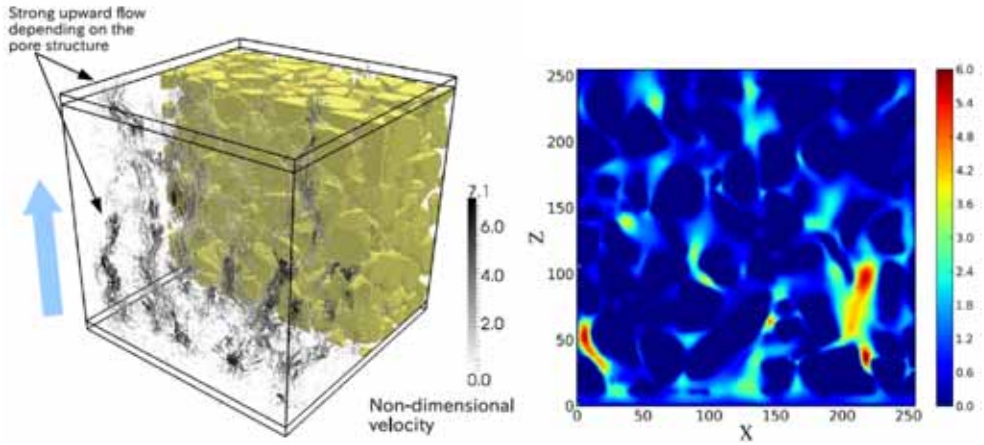


Name：Hidetaka Saomoto
Affiliation：Active Fault and Earthquake Research Center, National Institute of Advanced Industrial Science and Technology

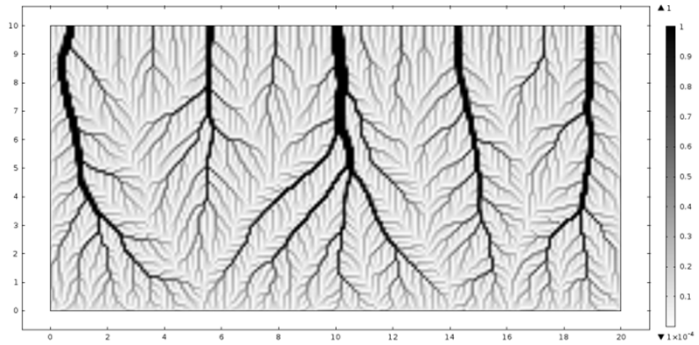


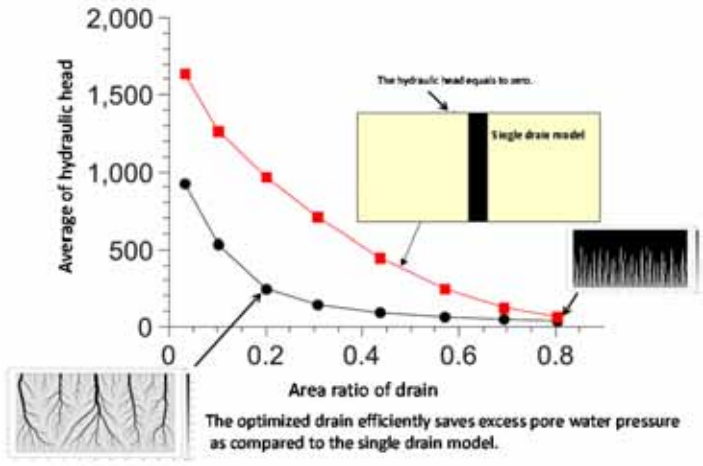
Shear band formation due to faulting process
(left: strike-slip, right: reverse dip-slip)

DEM simulation of ground deformation caused by fault rupture
Objective: Prediction of surface rupture zone.



Pore fluid simulation based on LBM with GPU acceleration
Objective: Construction of velocity model for ground water pollutio





The black region indicates optimized drain shape automatically obtained from the FEM simulation combining with the optimizer based on the SQP algorithm.

PDE (Partial Differential Equation) constrained optimization in the field of engineering
Objective: Improvement of the drain topology for liquefaction countermeasures (in this case).

Name：Naotaka KIKKAWA
Affiliation：National Institute of Occupational Safety and Health, Japan (JNIOSH)

Motivation
Reduce the fatalities due to rock fall events during tunnel excavation.

Background
Blasting would force to rearrange the stress surrounding a tunnel cutting face and then rock falls due to the stress relaxation.

Objective
Evaluate the stress rearrangement by blasting.

Experiment
Using a small size ignition charge, we blasted the bonded granular specimen which Toyoura sand was bonded by a liquid agent.

Simulation
Using the three-dimensional Discrete Element Method (DEM), we simulated the experimental blasting test.
Blasting was only considered as the effect of gas expansion, and then an element of spherical rigid wall was installed in the centre of the specimen. The spherical rigid wall was inflated until the maximum radius of 5mm and deflated until the initial radius of 1mm at a constant radius speed of 35mm/sec.

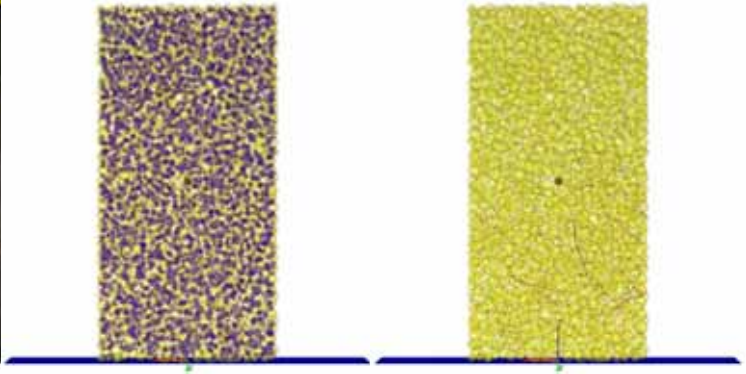
Results
Both experiment and simulation, the specimens were broken horizontally. For the simulation, the tension force occurred surrounding the blasting, its force still remained inside the specimen after blasting.

Conclusion
The tension force remained would stretch cracks

Experiment

DEM simulation
Sphere: yellow, Parallel-bond: blue
Force(compression): black, Force(tension): red

0 sec



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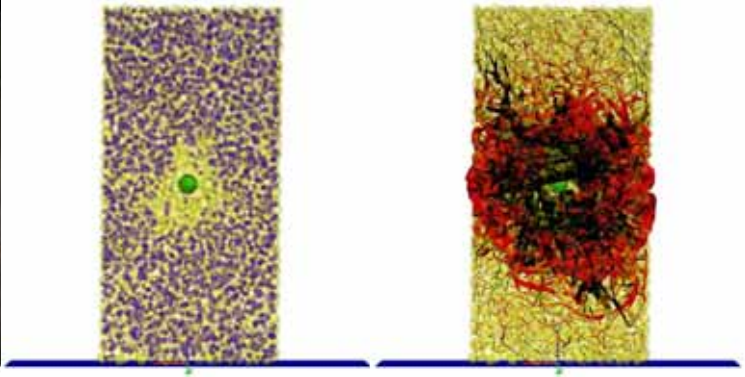

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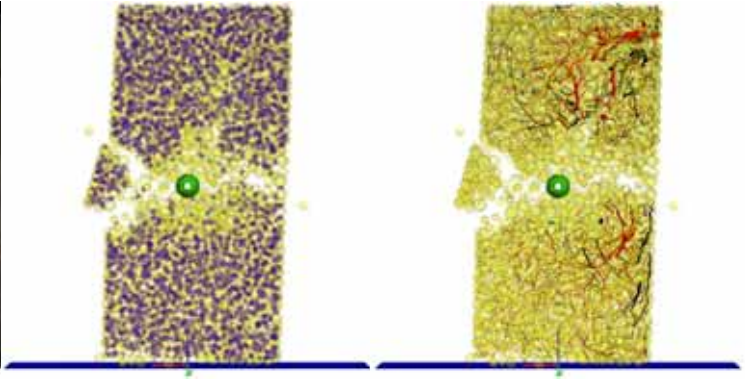
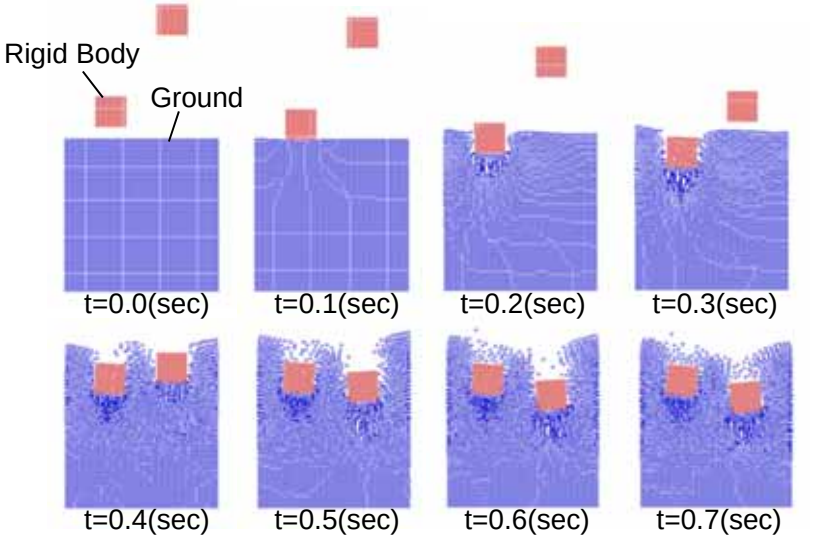
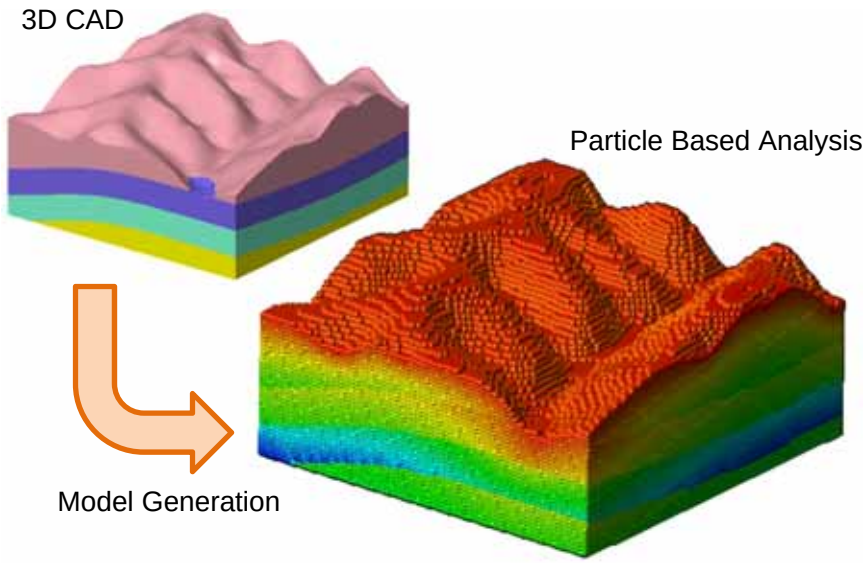


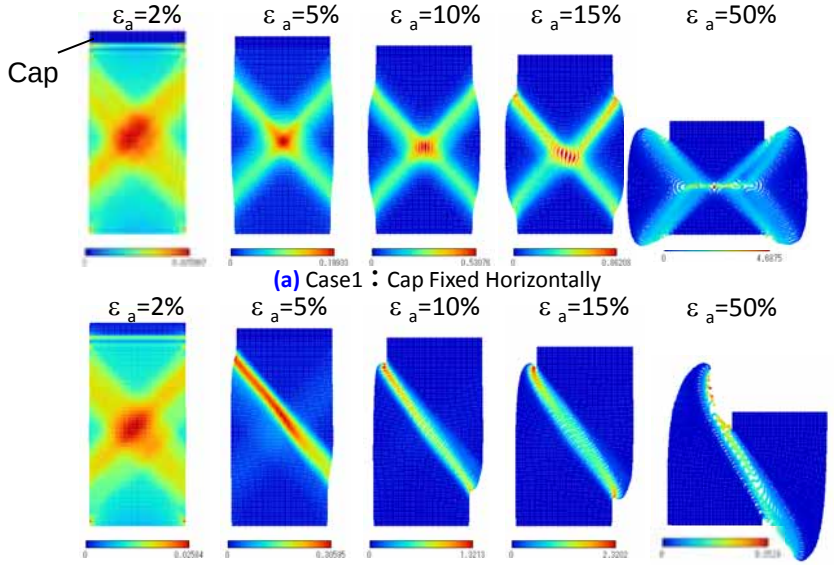
Name：Takatoshi Kiriyama
Affiliation：Shimizu Institute of Technology

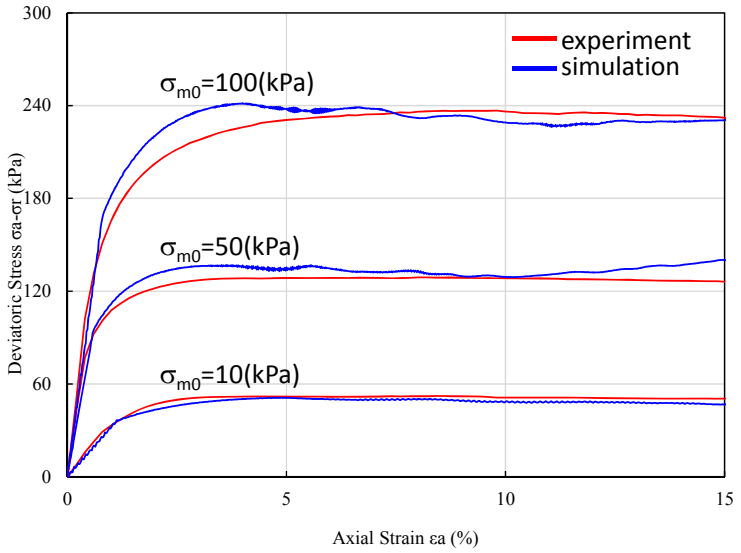


Penetration Simulation of Rigid Body Falling into Ground
Objective : To evaluate the applicability of MPM.



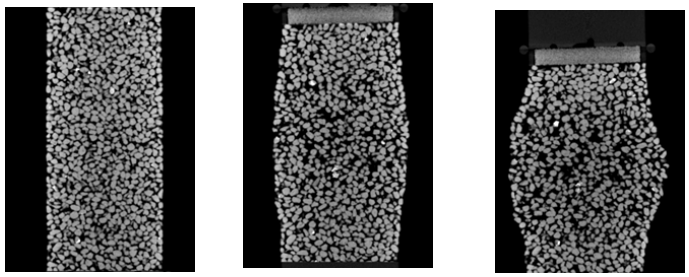
Particle Based 3D Model Generation using 3D CAD System
Objective: To reduce difficulties in the hand-made mesh generation and to avoid mesh-tangling during numerical simulation.



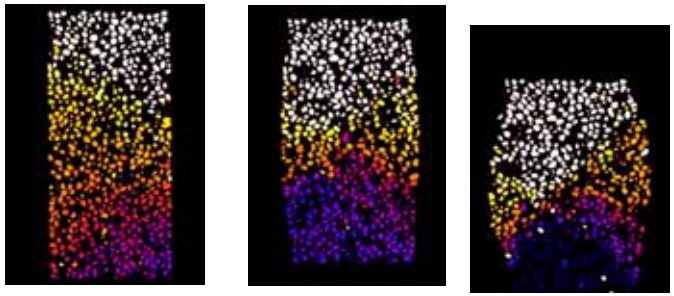


Difference of Shear Band Formation Depending on Cap Boundary
Objective: Investigation of shear band formation process using particle based simulations.

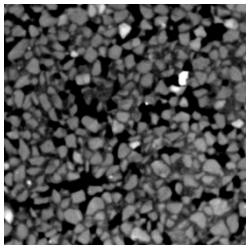
Name：Daiki TAKANO
Affiliation：Geotechnical Engineering Division, Port and Airport Research Institute



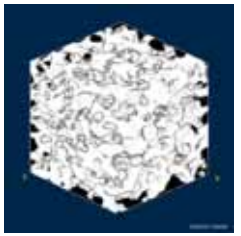
CT images of sand under triaxial compression



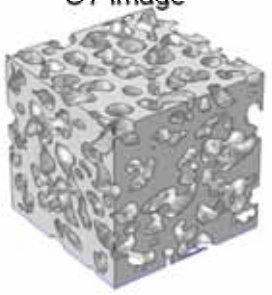
3D grain tracking:
color correspond to magnitude of displacement of individual grains.



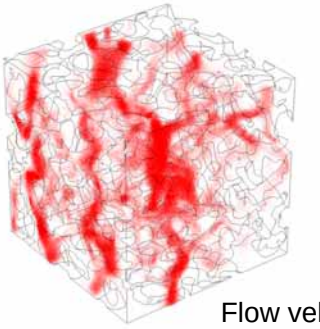
CT image



Extracted void space



Finite element mesh

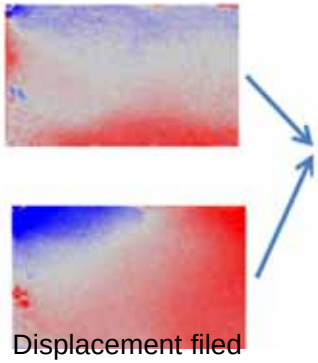


Flow velocity field

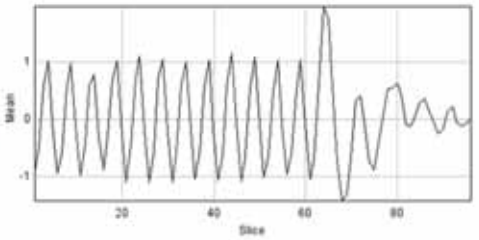
<u>Visualization and evaluation of mechanical behavior of granular materials</u>
Objective: Quantitative evaluation of mechanical behavior of granular materials using X-ray tomography and image analysis

<u>Seepage simulations in micro scale based on CT images</u>
Objective: Investigation of an effect of grain shape in seepage simulation using CT images.

Record ground behavior by high frame rate camera



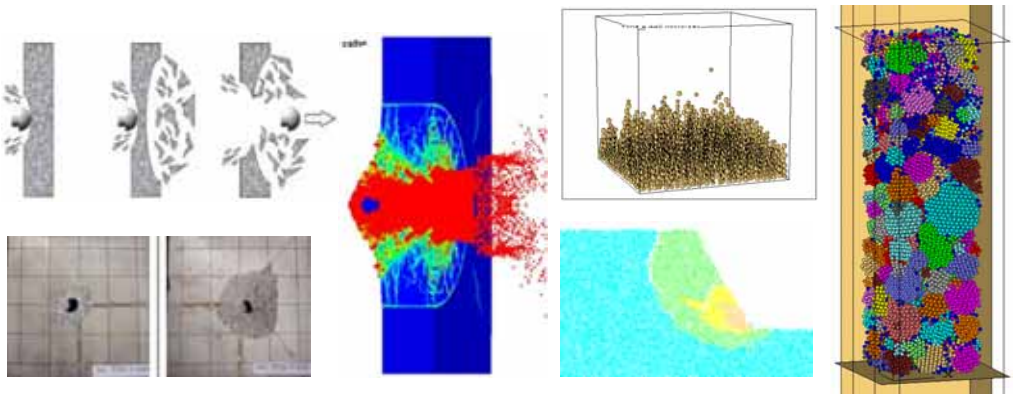
Displacement filed



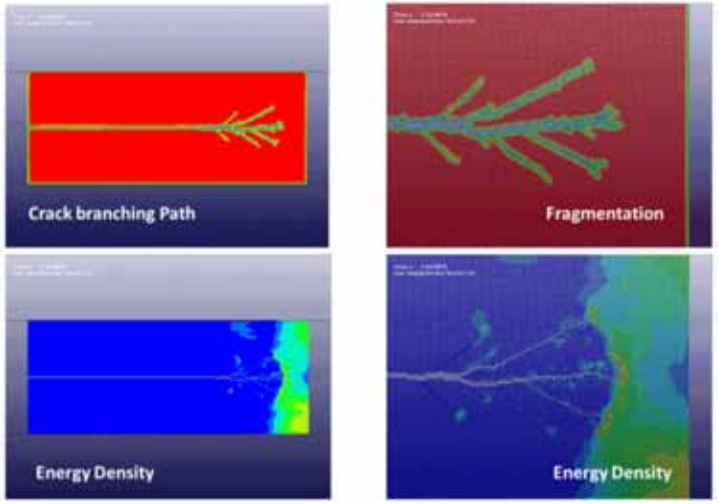
Time history of response acceleration of ground

<u>Dynamic centrifuge model test</u>
Objective: Investigation of an dynamic response using high speed camera and Digital Image correlation.

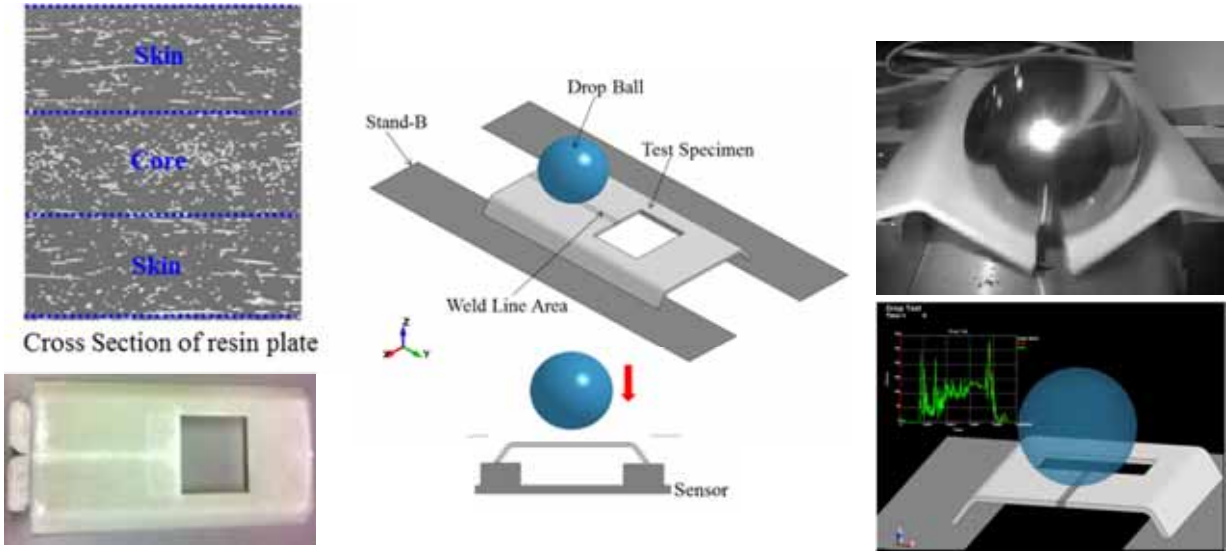
Name：Tatsuo Sakakibara
Affiliation：ITOCHU Techno-Solutions Corporation
Science & Engineering Systems Division



Continues and discontinuous simulations

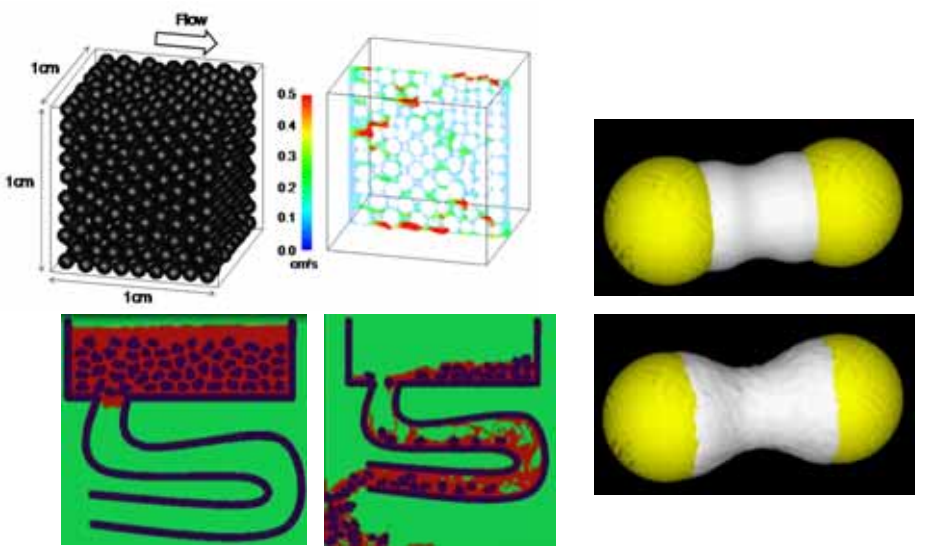


Fragmentation Analysis using DEM or SPH
Objective: Establishment of modeling procedure for crack propagation of solid material by particle method.

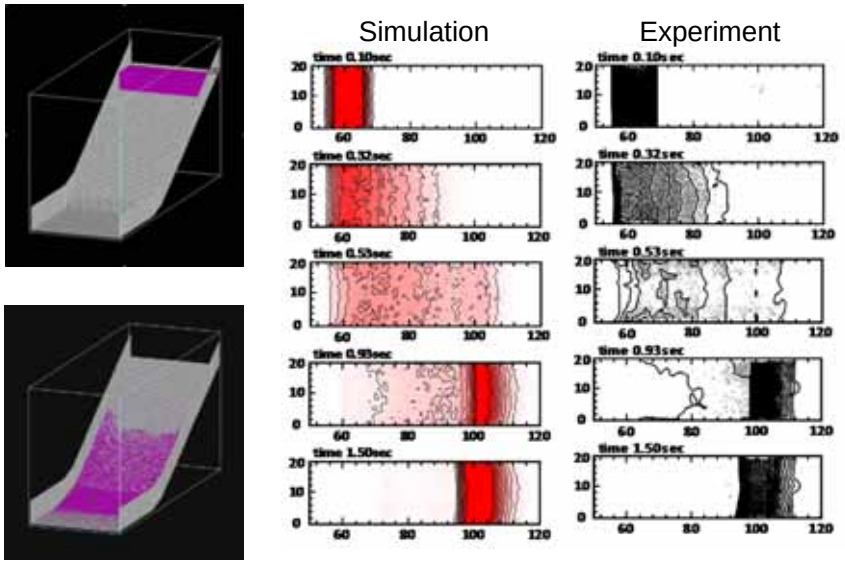


Multi scale simulations of composite material
Objective: Investigation of effect of micro structure such as glass fiber in resin.

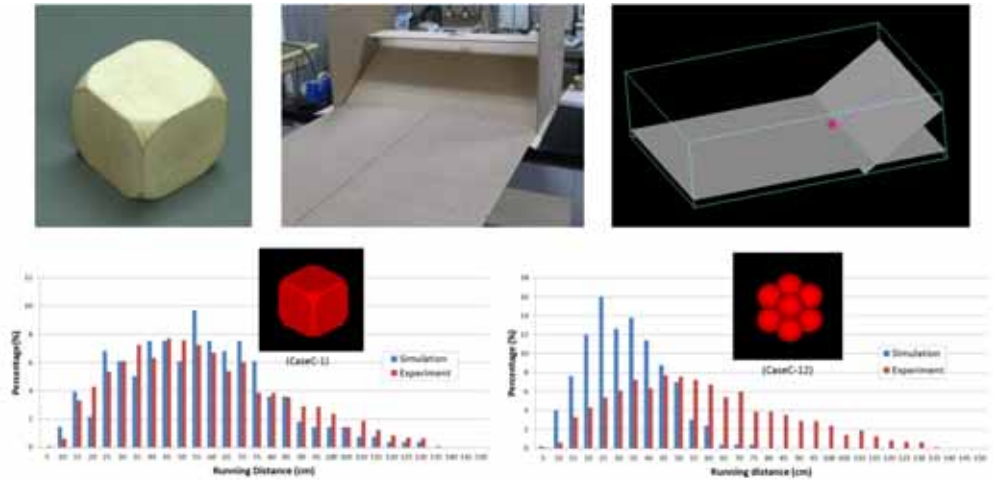
Name：Shuji Moriguchi
Affiliation：Tohoku University, International Research Institute of Disaster Science



Particle-fluid coupled analysis using DEM and CFD
Objective: Establishment of an numerical framework for direct simulation of soils.



Flow simulations of granular material using DEM
Objective: Investigation of an effect of grain shape in flow simulation of granular material.



A model test of rockfalls and it's simulations using DEM
Objective: Investigation of an effect of surface accuracy in rockfall simulations.

Name：Kenichi MAEDA
Affiliation：Nagoya Institute of Technology, Advanced Disaster Prevention Engineering Center

MPa

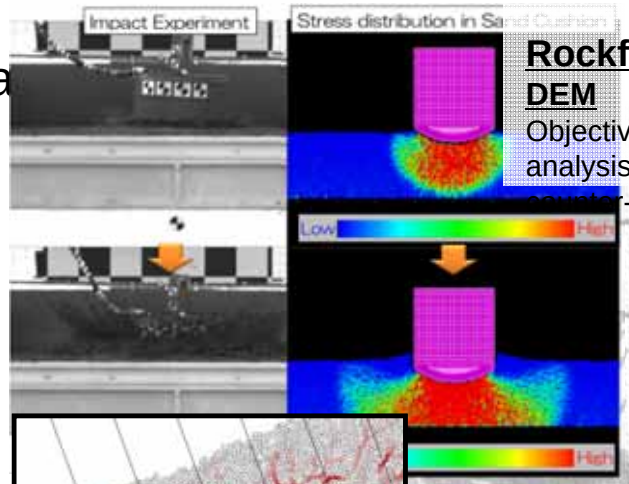
magnitude of action force

Pa

short

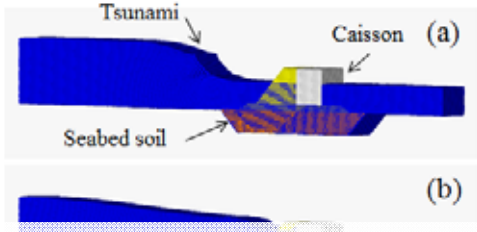
long

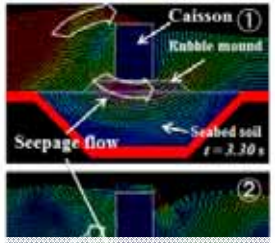
duration of action



Rockfall Project using DEM

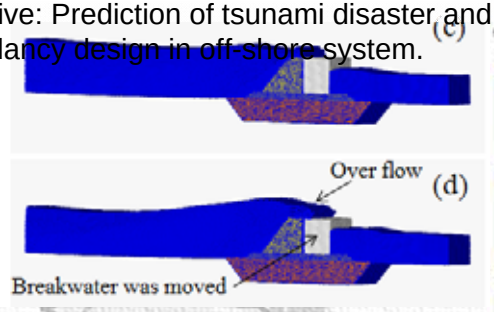
Objective: Impact propagation analysis and Proposal of counter-measure.

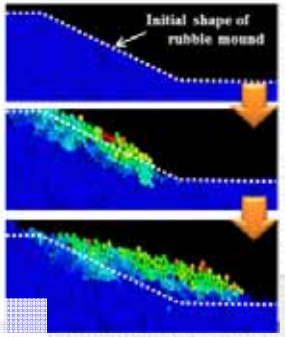


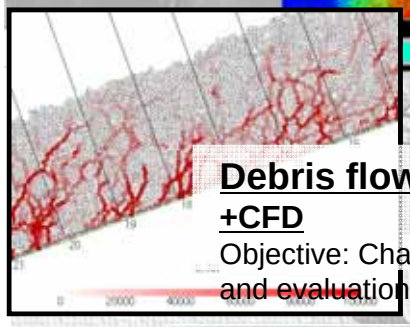


TSUNAMI Project using DEM and/or SPH with three phase coupling

Objective: Prediction of tsunami disaster and CAD for ductility and redundancy design in off-shore system.





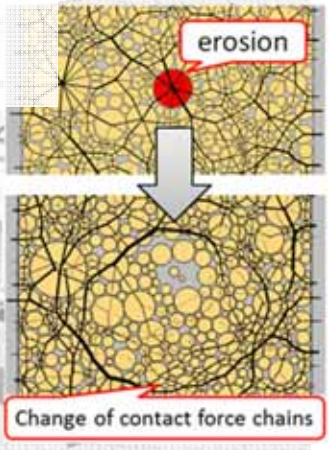


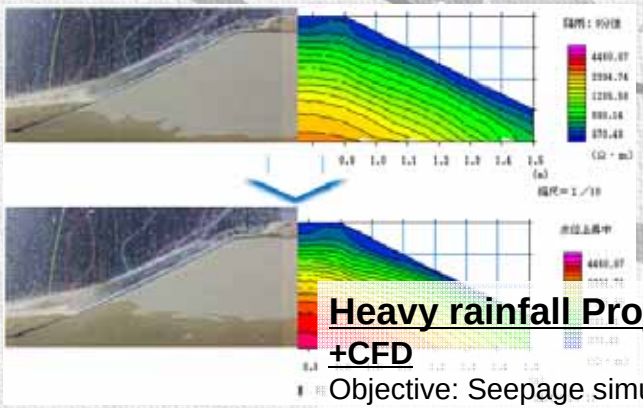
Debris flow Project using DEM +CFD

Objective: Changing grading in granular flow and evaluation of energy reduction.

Internal Erosion Project using DEM + CFD, SPH

Objective: Modeling duality of discrete and continuum modeling and prediction of progressive depression in 3 phases.



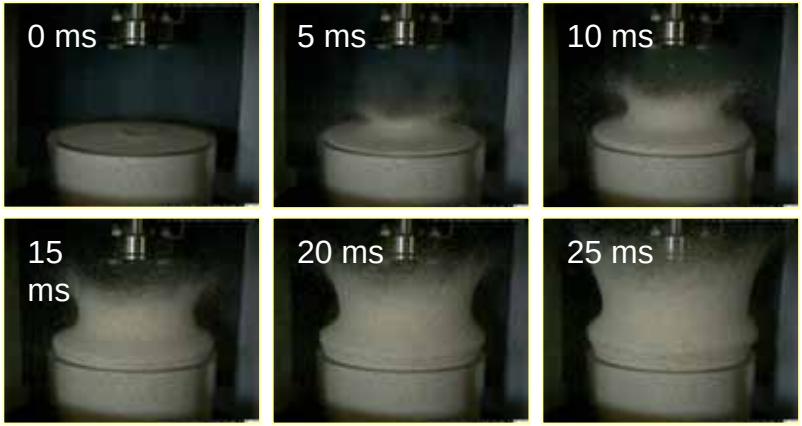


Heavy rainfall Project using SPH, DEM +CFD

Objective: Seepage simulation of rainfall and rapid action of water to soil with three phases and reduction evaluation of flood damage

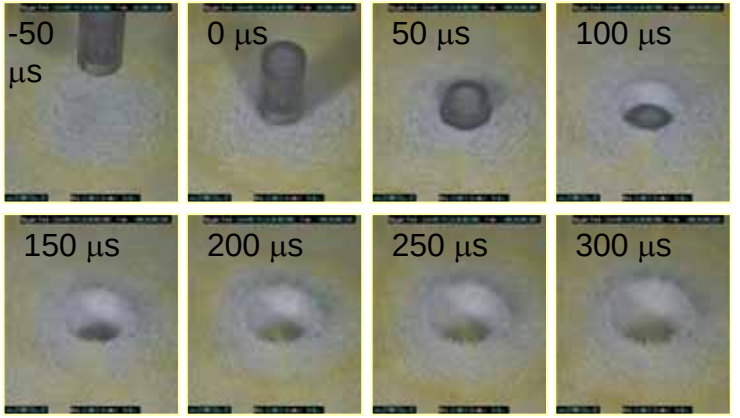
Name：Keiko Watanabe
Affiliation：Ritsumeikan University, Department of Mechanical Engineering

Development of vertical powder gun and gas gun
Objective: High-speed impact experiments.



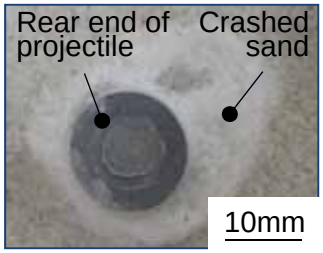
Impact velocity: 350 m/s
High-speed camera: MEMRECAMfx K3R (NAC)
Frame rate: 1,000 fps (every 5 frames), Exposure: 50 μs

Observation of various phenomena using high-speed camera
Objective: Investigation of behavior of ejecta induced by high-speed penetration into granular material.

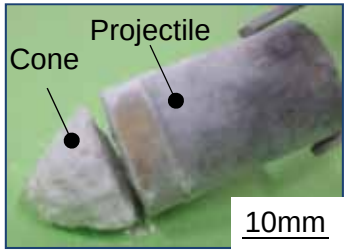


Impact velocity: 495 m/s
High-speed camera: ULTRA Cam HS-106E (NAC)
Frame rate: 200,000 fps (every 10 frames), Exposure: 0.3 μs

Objective: Investigation of behavior of projectile and sands during early penetration.



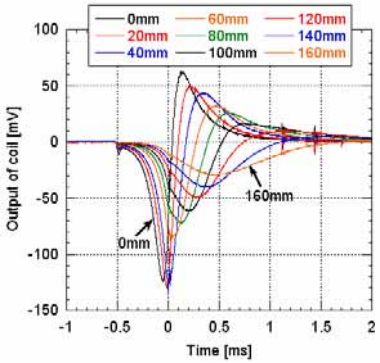
Circumferential crashed sands



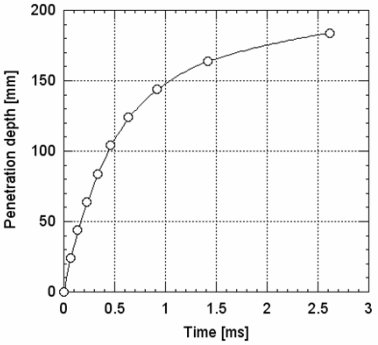
Massive crashed sands in front of projectile

Distribution of crashed

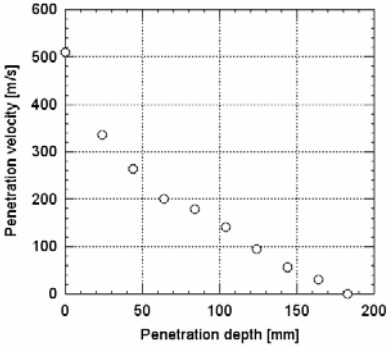
Penetration velocity measurement system



Output signals of coil



Penetration depth vs. time



Penetration velocity vs. depth

Impact velocity: 510 m/s, Final penetration depth: 182.6 mm , *t* =0: Impact time to sands surface

Measurement of penetration velocity using magnet-coil gages
Objective: Establishment of accurate measuring method of penetration velocity into sand.

Name：Masayuki Hyodo
Affiliation：Yamaguchi University, Dept. of Civil and Environmental Engineering

Cell pressure 30 MPa Back Pressure 20 MPa
Axial Load 200 kN Temperature control -35~50℃

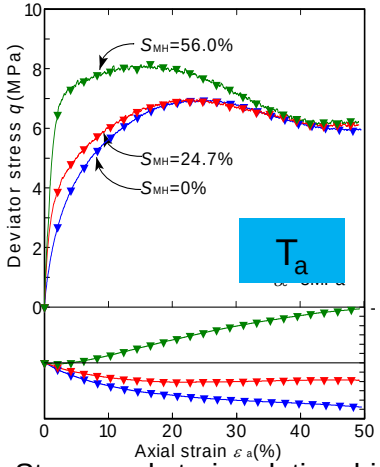
Methane hydrate triaxial testing apparatus

Objective: mechanical properties on methane hydrate bearing soils

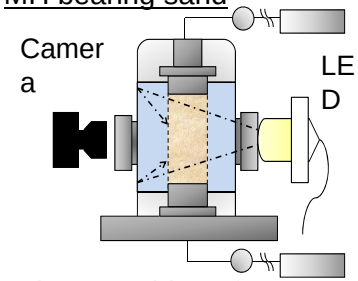
Confining pressure 20 MPa Back Pressure 20 MPa
Axial Load 200 kN Temperature control 0~30±1℃

Methane hydrate plane strain triaxial testing apparatus

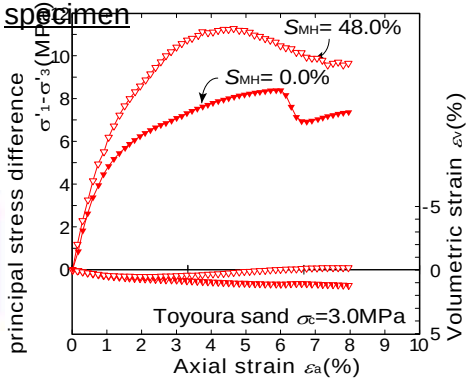
Objective: mechanical properties and global and local deformation of methane hydrate bearing soils

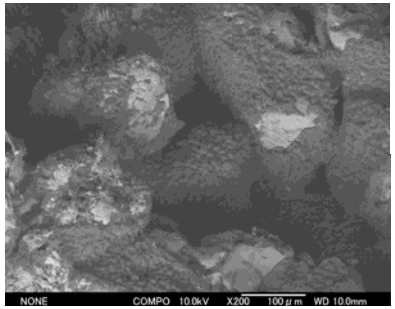


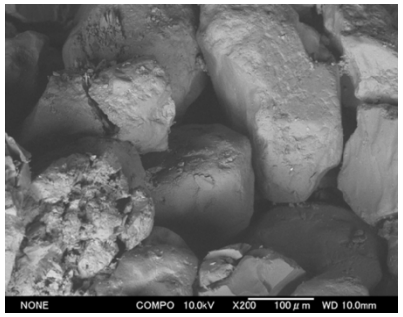
Stress and strain relationship for MH bearing sand



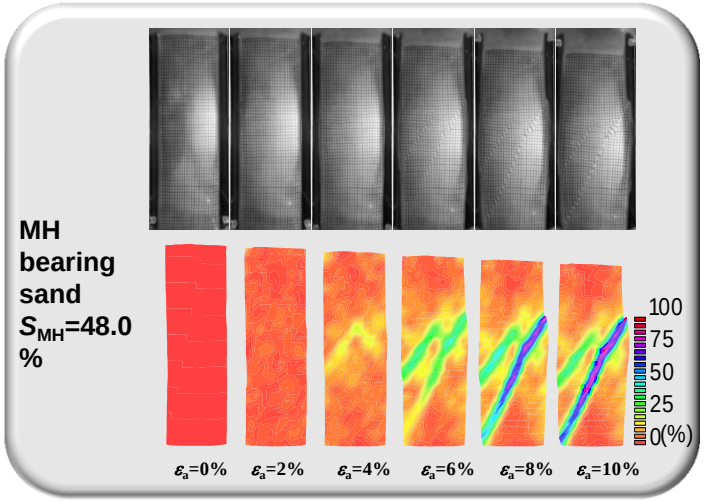
Photographing of specimen





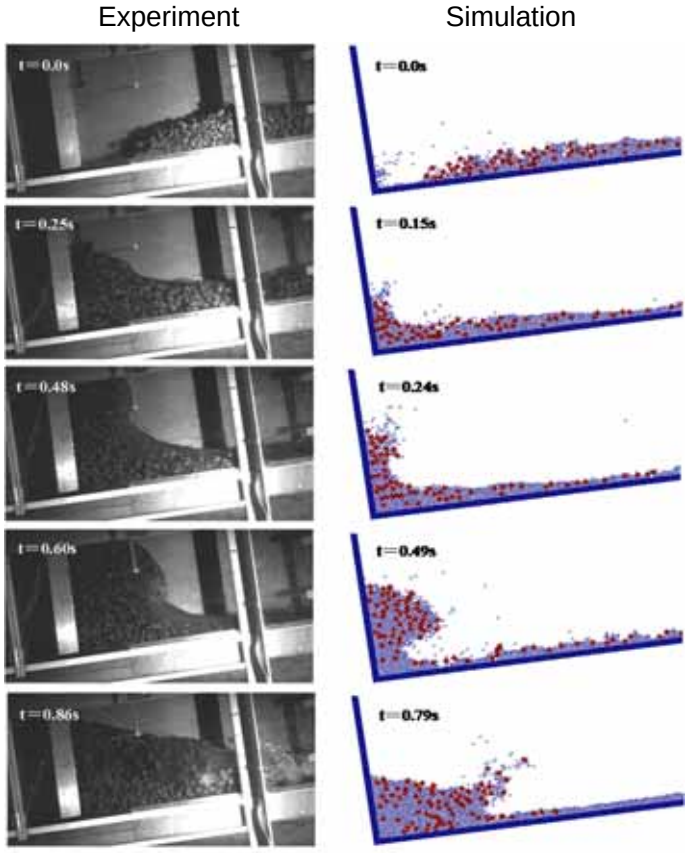


SEM images for MH bearing sand

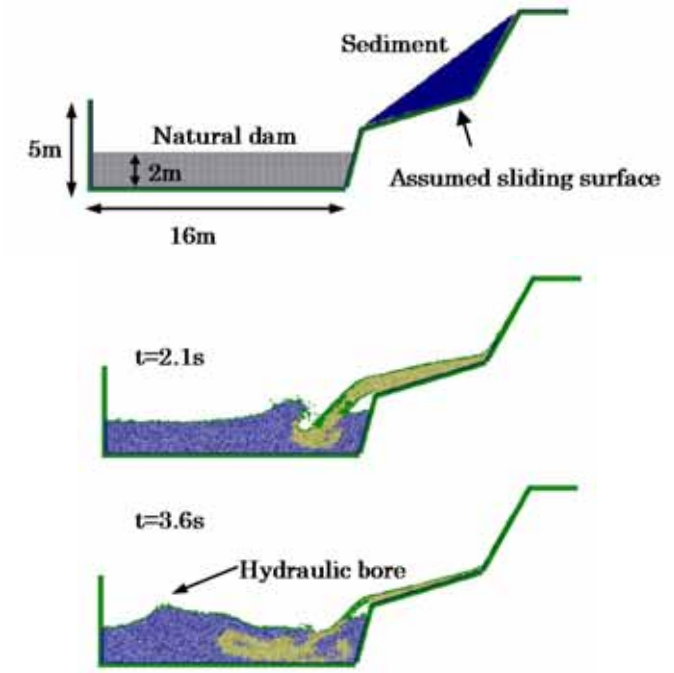


Global stress and strain relationship and local shear strain by plane strain test

Name：Masuhiro Beppu
Affiliation：National Defense Academy, Department of Civil and Environmental Engineering

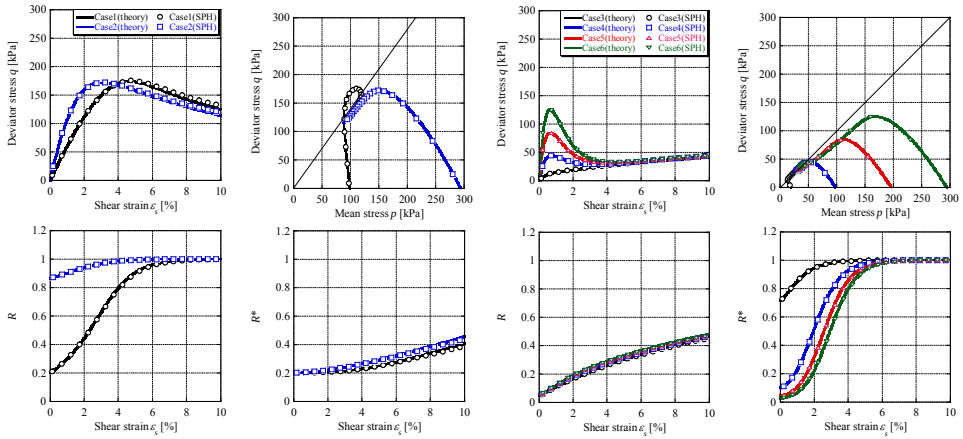


Numerical analysis of Debris flow using MPS and DEM
Objective: Evaluation of impulsive load due to impact of debris flow.



Flow simulations of hydraulic bore in natural dam using MPS
Objective: Evaluation of impulsive force due to hydraulic bore caused
by collapse of sediment into natural dam.

Name：Hideto Nonoyama
Affiliation：Nagoya University, Department of Civil Engineering
E-mail ：nonoyama@civil.nagoya-u.ac.jp

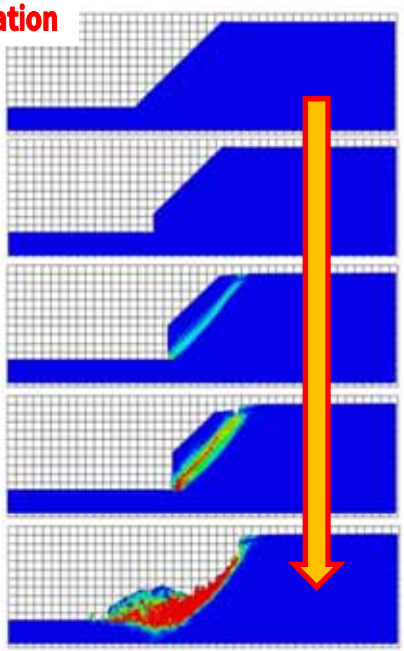


「Typical clay」 「Typical sand」

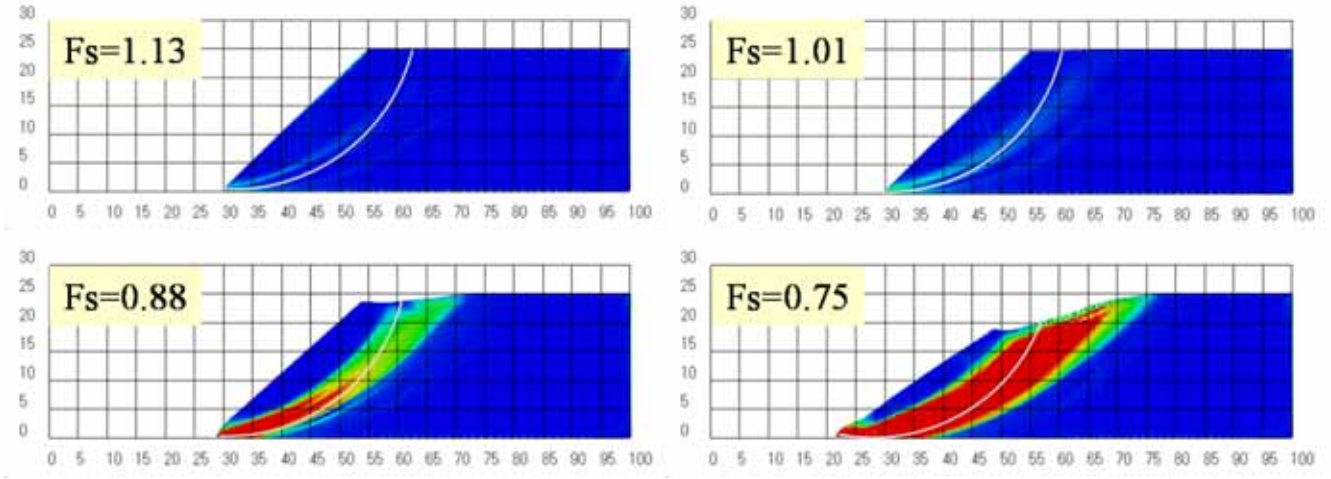
Simulation of shear test of soils using SPH method
Objective: Establishment of a numerical framework for meshfree method with an elasto-plastic constitutive model considering soil skeleton structure.

Real-scale slope excavation experiment

Simulation



Excavation analysis of ground using SPH method
Objective: Prediction of entire deformation process of ground from small strain region to large deformation region.



Slope stability and deformation analysis using SPH method
Objective: Estimation of stability and deformation of slope simultaneously