# Numerical simulation of strike slip fault using PDS-FEM

**Ryota Iwasaki* and Kenji Oguni†**

* Keio University Graduate School of Science and Technology
School of Science for Open and Environment Systems
Hiyoshi 3-14-1, Kohoku-ku, Yokohama 223-8522, Japan
e-mail: riwasaki114@a5.keio.jp

† Keio University Department of System Design Engineering
Hiyoshi 3-14-1, Kohoku-ku, Yokohama, 223-8522, Japan
Email: oguni@sd.keio.ac.jp – Web page :http://www.oguni.sd.keio.ac.jp

## ABSTRACT

Strike-slip faults often induce a typical echelon fault pattern on the top surface of the embedded soil. This echelon pattern of the cracks on the top surface of a layer subject to shear at the bottom can be observed regardless of the materials and scales. This typical echelon fault pattern is called Riedel shear. Since the sudden appearance of the specific length scale in the mechanical problems without typical length scale is counter-intuitive, complete explanation for the mechanics behind Riedel shear has not been provided.

The authors carried out numerical analysis of Riedel shear using PDS-FEM (particle discretization scheme finite element method). PDS-FEM employs discretization of the displacement and stress field using characteristic functions on conjugate geometries. This results in a particle physics model for solid continuum and thus, discontinuities in the displacement field due to failure can be easily yet rigorously treated. Using PDS-FEM, the process of the evolution of crack surface in a homogeneous isotropic linearly elastic rectangular plate of 150mm (W) x 250mm (D) x 50mm (H) under simple shear across the center line at the bottom surface of the plate has been simulated.

This numerical simulation shows i) appearance of Riedel shear on the top surface of the plate, ii) twist of the crack surface toward the top surface, and iii) alternative pattern of the growth of crack surface.

These results imply that Riedel shear is the consequence of the consecutive choice of the bifurcation solutions. Particle physics model given from PDS-FEM and explicit time integration in PDS-FEM enable us to capture the bifurcated solutions and to show sudden appearance of periodic solution in the problems without specific length scale.

## REFERENCES

[1] N. Kame, S. Saito and K. Oguni, “Quasi-static analysis of strike fault growth in layered media”, *Geophysics Journal International,* Vol.173, pp. 309-314, (2008).

[2] M. Hori, K. Oguni and H. Sakaguchi, “Proposal of FEM implemented with particle discretization for analysis of failure phenomena”, *Journal of the Mechanics and Physics of Solids*, Vol. 53, No.3, pp. 681-703, (2005).