【Grant-in-Aid for Scientific Research(S)】
Science and Engineering (Engineering Ⅱ)

Title of Project : Reevaluation of the seismic resistance of coastal areas in the event of large-scale serial ocean trench earthquakes, with a consideration of foundation reinforcement technologies

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Research Area : Geoengineering

Keyword : Foundation disaster prevention

【Purpose and Background of the Research】

Since the 1995 Kobe Earthquake, concentrated investments in seismic research have brought a marked step up in the precision of earthquake risk assessments, especially in coastal areas. But response measures in seismic geoengineering have not kept up as fully as they should have done with these rapid advances.

Given the expected imminent arrival of some major ocean-trough earthquakes (which are also believed to be serially linked), the object of this research is to start from a precise description of the elastoplastic profiles of soils made up of alternate layers of naturally deposited (alluvial/diluvial) clay and sand, and of manmade foundations made out of intermediate soils, and, with this as a basis, to use a new technology to evaluate the seismic and post-seismic resistance capabilities of natural and artificial soils in systems with the seawalls, embankments, structure bases or whatever other foundational works they support, and in this way to pick out the places that need reinforcing and to verify the improving effects of applying different sorts of ground reinforcement technology.

【Research Methods】

The finite element code GEOASIA, developed in the Nagoya University, is a new type integrated technology based on an elastoplastic constitutive equation, the SYS Cam clay model, which provides a continuous description of all types of soil right through from naturally deposited clays and sands to intermediate soils (“All Soils”), in all states from deformed to destroyed (“All States”), and under all sorts of external conditions, dynamic or static (“All Round”).

This research topic proposes to address three challenges: 1) Through conducting a full range of laboratory tests on various types of soil materials, it will (further) validate the SYS Cam-clay model incorporated in the analysis code while seeking to raise the speed and capacity of the code as a whole. 2) Through building up systems of cooperation with public and private organizations within which various real-life problems of seismic resistance reevaluation need to be faced, it will lead toward revised principles of construction and design for earthquake resistance. 3) Through providing an education program in which students can master an analytical technology, research of this kind will ensure the training of expert analysts who are thoroughly versed in this field of seismic geoengineering.

【Expected Research Achievements and Scientific Significance】

The confirmation and dissemination of a computational technology applicable to all kinds of soils, providing a continuous analysis all the way through from the seismic stability at the time of an earthquake to the subsequent deformation behavior.
Advancements in the field of seismic geoengineering by the clear computation of the resistance-enhancing effects of various foundation reinforcement methods.
A training of specialists with competence in this new technology.

【Publications Relevant to the Project】

- Noda, T., Asaoka, A. and Nakano, M., Soil-water coupled finite deformation analysis based on a rate-type equation of motion incorporating the SYS Cam-clay model, Soils and Foundations, Vol.48, No.6, 771-790, 2008.
- Asaoka A. and Noda, T., All soils all states all round geo-analysis integration, International Workshop on Constitutive Modelling - Development, Implementation, Evaluation, and Application, 11-27, 2007.

【Term of Project】 FY2009-2013

【Budget Allocation】 68,600 Thousand Yen

【Homepage Address and Other Contact Information】

http://jglobal.jst.go.jp/detail.php?JGLOBAL_ID=200901016948299943&t=1&d=1&q=1000162445