

2.5.8 Laboratory : Agricultural Facilities Engineering

Member:	Professor	Murakami Akira, Dr. Agric. Sci.
	Associate Professor	Kobayashi Akira, Dr. Eng.
	Assistant Professor	Kiyama Shouichi, Dr. Agric. Sci.
	Doctor's program	1
	Master's Program	5
	Undergraduate	7

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Simulation of behavior of facilities and foundation

To examine the mechanical and environmental safety of agricultural facilities and those foundations, the simulation methods were developed. DEM was used to understand the macroscopic failure of soil composed of the small particles. The new inverse analysis method was tried to identify the mechanical parameters of foundation. Moreover, the estimation method of heterogeneous distribution of hydraulic parameters was developed to simulate the groundwater behavior in subsurface dam.

b) Non-destructive method for long used hydraulic facilities for irrigation

To make the strategy for the maintenance of long used hydraulic facilities for irrigation activity, non-destructive methods such as impact acoustic method, electrical resistivity survey and electro-magnetic method to investigate the state of the structure or subsoil has been developed. The developed method was applied to the actual irrigation tanks, and the inner situation of tanks having the leakage was examined.

c) Research on failure mechanism of irrigation tank caused by overtopping and risk analysis of the irrigation tank damages

Many traditional irrigation tanks easily fail due to the overtopping of the pond water by a heavy rain. But the failure process is not predicted so well. So the prediction method of time expended to the failure was developed. Also based on the data of many failed irrigation tanks in AWAJI Island caused by the heavy rain of a typhoon, a risk analysis was carried out.

d) Eco-efficiency assessment of eutrophication for the watershed environmental management

Quantifying watershed based integrated environment and economic accounting and eutrophication potential, we investigate how to manage the sustainable water environmental development in the future inter-sectoral and inter-regional activities.

A-2.Publications and presentations

a) Publications

Books

- Akira Kobayashi: 2.1 Irrigation tank, Proposal from JGS to prevent the disasters by earthquake, downpour and flood, JGS

Original Papers

- Murakami, A., Nishimura, S., Suzuki, M., Mori, M., Kurata, T. and T. Fujimura: Determination of partial factors for verification of bearing capacity of shallow foundations beneath open channels, Trans. JSIDRE, No.259, pp.71-78, 2009 (in Japanese).
- Murakami, A., Nishimura, S., Suzuki, M., Mori, M., Kurata, T. and T. Fujimura: Reliability analysis for bearing capacity of open channel, Trans. JSIDRE, No.260, pp.69-75, 2009 (in Japanese).
- Fujisawa, K., Murakami, A. and S. Nishimura: Computational method to analyze internal erosion and transport of soil properties, Trans. JSIDRE, No.260, pp.85-93, 2009 (in Japanese).
- Hommels, A., Murakami, A. and S. Nishimura: A comparison of the Ensemble Kalman filter with the unscented Kalman filter: Application to the construction of a road embankment, GEO International, Jan. 2009, pp.52-54, 2009.
- Kiyota, K., Kawasaki, S. and A. Murakami: Solidification of dredged clayey soil from farm ponds based on biochemical grouting, Jour. Japan Soc. Eng., Geol., Vol.50, No.2, pp.70-78, 2009 (in Japanese).
- Takisawa, T., Murakami, A. and S. Nishimura: Experimental study on the efficient dehydraion of dredged sludge with a compact filter press, Ground Engineering, No.26, pp.7-14, 2009 (in Japanese).
- Nishimura, S., Mori, S., Fujisawa, K. and A. Murakami: Risk evaluation and reliability-based design of earth-fill dams for overflow due to heavy rains, Journal of Applied Mechanics, Vol.12, pp.89-97, 2009 (in Japanese).
- Murakami, A., Nishimura, S., Fujisawa, K., Nakamura, K. and T. Higuchi: Data assimilation in geotechnical analysis using the particle filter, Journal of Applied Mechanics, Vol.12, pp.99-105, 2009 (in Japanese).

- Fujisawa, K., Murakami, A. and S. Nishimura: Numerical analysis of piping development induced by loss of soil particles, *Journal of Applied Mechanics*, Vol.12, pp.395-203, 2009 (in Japanese).
- Murakami, T., Murakami, A. and H. Sakaguchi: Numerical study on the shear strength by direct shear test in Distinct Element Method, *Journal of Applied Mechanics*, Vol.12, pp.533-540, 2009 (in Japanese).
- Takisawa, T., Murakami, A., Nishimura, S. and K. Murakami: Effect of mixing sludge dredged from farm ponds with weathered granite soil on germination and growth of plant, *Trans. JSIDRE*, Nol.263, pp.33-39, 2009 (in Japanese).
- Rutqvist J., Börgesson L., Chijimatsu M., Hernelind J., Jing L., Kobayashi A., Nguyen S. : Modeling of damage, permeability changes and pressure responses during excavation of the TSX tunnel in granitic rock at URL, Canada, *Environmental Geology*, Vol. 57, pp.1263-1274, 2009
- Rutqvist, J., Bäckström, A., Chijimatsu M., Xia-Ting Feng, Peng-Zhi Pan, Hudson J., Jing L., Kobayashi A., Koyama T., Hee-Suk Lee, Xiao-Hua Huang, Rinne M., Shen B. : A multiple-code simulation study of the long-term EDZ evolution of geological nuclear waste repositories, *Environmental Geology*, Vol. 57, pp.1313-1324, 2009
- Nguyen, T.S., Börgesson, L., Chijimatsu, M., Hernelind, J., Jing, L., Kobayashi, A., Rutqvist, J. : A case study on the influence of THM coupling on the near field safety of a spent fuel repository in sparsely fractured granite, *Environmental Geology*, Vol. 57, pp.1239-1254, 2009
- Hudson, J.A., Bäckström, A., Rutqvist, J., Jing L., Backers, T., Chijimatsu, M., Christiansson, R., Xia-Ting Feng, Kobayashi A., Koyama T., Hee-Suk Lee, Neretnieks, I., Pan, P.-Z., Rinne, M. and Shen, B.-T. : Characterising and modelling the excavation damaged zone in crystalline rock in the context of radioactive waste disposal, *Environmental Geology*, Vol. 57, pp.1275-1297, 2009
- Kobayashi A., Yamamoto K., Inoue K. and Aoyama S. : Permeability estimation from fracture frequency by indicator simulation, *Journal of Rainwater Catchment Systems*, Vol.14, No.2, pp. 1-8, 2009
- Fujisawa K., Kobayashi A. and Aoyama S. : Theoretical description of embankment erosion due to overflow, *Géotechnique*, 59, No. 8, pp.661-671, 2009
- Kiyama Shoichi, Development of a Web-based Application System on Economic Valuations of Regional Development and Environmental Planning, *Environmental Systems Research*, 37(1); 57-64, 2009 (in Japanese).
- Kiyama Shoichi, Feasibility of Rural Regeneration by Cooperative Watershed Resources Management in Japan, *International Journal of Environment and Sustainable*

Development, 9(1/2/3), 269-293, 2010.

Reviews

- Kobayashi Akira: Assessment of Life Cycle Cost of Irrigation Facilities, Geotechnical Engineering Magazine, Vol.57, No.3, Ser. No. 614, pp.22-25, 2009

Reports

- Kobayashi A.: Development of preventive maintenance method by considering the life cycle cost of irrigation hydraulic structures, Report of Sciences Research Grant, Basic Research (B) No. 18380142, 2009

b) Conference and seminar papers presented

- H-21 National conference of JSIDRE: 11 papers
- 12 th Notional symposium of applied mechanics: 4 papers
- National Symposium of Environmental System, JSCE: 1 paper
- EIT-JSCE Joint International Symposium, Monitoring & Modelling in Geo-Engineering: 2 papers
- International Symposium of Rock Mechanics: Rock Characterization, Modeling and Engineering Design Methods: 1 paper
- International Symposium on Rural Planning 2010: 1 paper
- International Symposium on Prediction and Simulation Methods for Geohazard Mitigation: 1 paper
- International Offshore and Polar Engineering Conference: 1 paper
- Safety, Reliability and Risk of Structures, Infrastructures and Engineering Systems, (ICOSSAR2009): 1 paper

A-3.Off-campus activities

Membership in academic societies

- Murakami A. : Japanese Geotechnical Society (Vice president, Chairman of Election Committee, Vice-Chairman of President Special Committee, Vice-Chairman of Promotion Committee of Public Interest Corporation, Chairman of Awards Committee), Japanese Society of Irrigation, Drainage and Reclamation Eng. (Board, Editor of Trans.JSIDRE, Member of Dam Committee, Member of Sawada Awards Committee, Member of Publishment Committee), Japan Soc. Civil Eng. (Fellow, Member of Applied Mechanics Committee), Japan Rainwater Catchment Systems Association (Member), Japan Society for Computational Methods in Engineering (Councilor), Research Institute of Signal Processing,

Japan (Editorial Board)

- Kobayashi A. : Japanese Society of Irrigation, Drainage and Reclamation Eng. (member of committee of dam, Officer of Kyoto branch), Japanese Geotechnical Society (Domestic member of ATC8), Japan Soc. Civil Eng.(Member), Japanese Association of Groundwater Hydrology (Member), J. Soc. Computational Eng. (Member), Int. Soc. of Rock Mechanics (Member), Japan Rainwater Catchments System Association (councilor).
- Kiyama S. : Japanese Society of Irrigation, Drainage and Reclamation Eng. (Member), Japanese Geotechnical Society (Secretary of Kasai branch), Japan Soc. of Civil Eng. (Member), Society for Environmental Economics and Policy Studies (Member)

Membership in Science Council of Japan, etc.

- Murakami A. : Chairman of execution committee of the 58th symposium of theoretical applied mechanics

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Scientific Research(B) : Murakami A. : Functional diagnostic system by data assimilation and unified measurement for stock management of soil structure.
- Scientific Research(B) : Kobayashi A. : Asset management method of irrigation hydraulic structures for risk of disaster of earthquake and downpour
- Scientific Research(C) : Kiyama S. : Conducive Agricultural Resources Management to Sound Water Cycle and Equitable Regional Benefit Allocation

A-4.International cooperation and overseas activities

Membership in academic societies

- Murakami A.: International Society of Soils Mechanics and Geotechnical Engineering (Technical Committee 34, Secretary), International Association for Computer Methods & Advances in Geomechanics (Board Member), Multidisciplinary International Society on Inverse Problems in Science and Engineering (Member)
- Kobayashi A.: Korean Nuclear Society, Referee of International Journal

International meetings(country,roles)

- Kobayashi A. : 4th International Conference on Coupled THMC Processes in Geosystems: Fundamentals, Modeling, Experiments and Applications (member of the International Scientific Advisory Committee) , International Symposium on Prediction and Simulation Methods for Geohazard Mitigation (Fukuoka, presentation), Safety, Reliability and Risk of Structures, Infrastructures and Engineering Systems, (Chiba, presentation)

- Kiyama S.: International Symposium on Rural Planning 2010 (Kyoto, presentation)

B.Educational Activities(2009.4-2010.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level: Seminar in Rural Facility Engineering (Kobayashi and Kiyama), Applied Mechanics (Kobayashi shear), Soil Mechanics and Concrete Engineering (Kobayashi), Laboratory Course in Soil Mechanics, Concrete Engineering and Environmental Geotechnique (Kobayashi and Kiyama), Exercise in Information Processing, Basics (Kiyama, shear), Seminar in Agricultural and Environmental Engineering (Murakami shear), Design of facilities for agricultural engineering (Murakami)
- Graduate level: Planning and Design of Rural Facilities (Murakami), Numerical Science of Structural Design (Kobayashi), Laboratory Course in Agricultural Facilities Engineering (Kobayashi), Advanced Course of Data Processing for Design I (Kobayashi), Advanced Course of Data Processing for Design II (Murakami)

B-2.Off-campus teaching etc.

Part-time lecturer

- Murakami, A.: Okayama Univ., (Structural Mechanics I & II, Management of Environmental Structures, Management of Environmental Facilities), Nagoya Institute of Technology (Special Lecture I on Scientific and Engineering Simulation), Kobe Univ., Visiting Professor
- Kobayashi A.: Tokyo Institute of Technology (Underground environment)

B-3.Overseas teaching

International students

- International students : Doctoral 1 (Bangladesh)

C.Other Remarks

- Murakami A.: Member of council for engineering problems in design and construction of

dams for irrigation use in Kyusyu and Chu-Shikoku area (JIID), Member of the committee of performance design of irrigation structures, JIID., Chair of the subcommittee of foundation and soil structure in the committee of performance design of irrigation structures, JIID.,

- Kobayashi A.: Member of council for huge earthquake countermeasure (Tokai agricultural administration office), Chair of committee for asset management of irrigation facilities (Shiga prefecture), Chair of committee of new technology introduction (Kinki agricultural administration office), Member of council for performance of seismic countermeasure, Member of technical committee for Iwate-Miyagi earthquake, Member of council for engineering problems in design and construction of dams for irrigation use, Member of the committee for seismic technology of irrigation structures, Member of the committee of performance design of irrigation structures, JIID., Member of committee of dams for irrigation use, Member of committee on long use of dams for irrigation use, JSIDRE, Member of the committee on the research activity of geological disposal, Member of the committee on the advanced development of chemical effect on disposal system, Japan Nuclear Cycle Development Institute

- Kiyama S.: Committee member of environmental planning of HIYOSHI dam water resource region, Committee member of “Edu-tope” Project of Kyoto city Shirakawa high school of total support.