JSIDRE Awards (1987)

The following (persons) received the JSIDRE Achievement Awards for fiscal 1987. The award ceremony and the authors' lectures were held on the occasion of 1987 JSIDRE meeting at Kagoshima University on August 20, 1987.

The total number of recipients of the JSIDRE Awards is 89, 105 persons, and recipients of the Dr. Ueno Award number 18.

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Science Award

A Series of Studies on Hydraulic System Analysis and Design of Irrigation Main Pipelines

Kotaro Onizuka,* Katsumi Naito,** and Kazumi Iwasaki***

Since about 1960, distribution pipeline systems have been successfully introduced to field irrigation projects in Japan. Several years later, this trend spread also to paddy field projects, and more pipelines have been adopted as on-farm delivery systems for paddy field irrigation. Nowadays, large-scale irrigation main pipelines are put to use or under construction in many districts throughout the country, in good expectation of realizing effective use of water resources as well as rational water management to cope with variety of demand.

Irrigation main pipeline systems consist of various components such as pumps, valves, farm reservoirs, storage reservoirs, pressure regulating tanks and so on. Rational planning and design of such complex systems require effective methods of analysis to forecast and evaluate the transient phenomena that accompany various operations for controlling and regulating flows in the systems.

Also, adequacy of the system layout should be evaluated quantitatively in view of the operating performance and the water management so that one may attain the optimal setting of pipes, valves, and storage capacities with their respective functions well coordinated.

In order to develop a practical method of hydraulic system analysis and to provide workable design procedures supported by a clear design policy for the solution of the aforementioned problems, the present studies were performed jointly by the three

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authors in three different institutions, i.e., a national university, a national research institute, and a national administrative division.

As the practical method of analysis, a slow transient analysis method was developed based on the conventional rigid water column theory for the surge-tank system analysis; the rigid theory for the single-pipe system was generalized and extended to branching pipelines and pipe networks. This method made it possible to calculate various slow transients other than water hammer phenomena; a system of ordinary differential equations of the first order that describes transient behavior of the pipeline systems is solved numerically on the computer.

A general-purpose computer code was developed as a tool of analysis and simulation of the unsteady flow phenomena in complex pipe systems. Efficiency of the algorism was confirmed, and the computer code was refined into a simulation program called SIMPL, which greatly facilitated the quantitative analysis of complex water management systems.

Experience with the simulation by SIMPL of many pipeline systems, both existing and being planned, strongly suggested that irrigation main pipeline systems should be subject more directly to supervisory control on the supplier's side, thereby restricting the peak flow rates within the permissible ranges adjusted to irrigation schedules. This is consistent with rational and efficient use of limited water resources, and may be termed "supply-oriented" design and management policy. Most of the existing main pipeline systems are, on the contrary, subject to unpredictable changes in terminal flow rates caused by free hydrant operation by consumers. This tends to result in excessive use of water because of the difficulty in balancing supply with demand without failure, and may be termed "demand-oriented" design and management policy.

The particular importance of the "supply-oriented" design policy was recognized and confirmed in the course of the present studies. In line with this policy, several improved designs for the regulating valve manifolds and special inlet structures of the reservoirs were proposed and tested. Rational estimates of the storage capacity of the intermediate reservoirs were made possible by means of the SIMPL simulation. The improved designs were adopted in the latest projects with satisfying results, showing that the analysis method and the design procedures developed by the authors are both practical and useful for the planning and design of the large-scale irrigation main pipeline systems.

Bibliography


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Science Encouragement Award

Studies on Characteristics of Frost and Thawy Soils

Tetsuaki Nagasawa*

Works on which the award is based

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   Trans. JSIDRE, No. 54, 6–10, 1974
2. Influences of freezing and thawing processes on soil strength — Studies on characteristics of frost and thawy soils (II) —
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3. Some physical properties of thawy soils — Studies on characteristics of frost and thawy soils (III) —
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5. Influences of freezing and thawing on water resistance of soil — Studies on characteristics of frost and thawy soils (V) —
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7. The influence of the freeze-thaw process on soil structure — Studies on characteristics of frost and thawy soils (VII) —
   Trans. JSIDRE, No. 123, 49–55, 1986
8. The influence of initial soil conditions on the structure of thawy soil — Studies on characteristics of frost and thawy soils (VIII) —
   Trans. JSIDRE, No. 123, 57–64, 1986

Summary of work

The freeze-thaw phenomena of ground surfaces in cold regions exert various influences upon agricultural lands, structures and facilities, which have very important

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