Development of Reliability Assessment Model for Levee Embankment Considering Stochastic Rainfall Variation

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Recently, due to abnormal weather caused by global warming and rapid urbanization, the total amount of rainfall and the total number of heavy rain days has increased. As a result, the natural damage associated with flood disasters has increased dramatically. A robust and economical flood prevention system is required. Hence, in this study, we have been developed a reliability assessment model for levees for a flood disaster prevention system.

To develop a reliability assessment model which considers stochastic characteristics of temporal rainfall variation, plausible rainfall patterns are generated by constrained multivariate Monte Carlo simulation including log-ratio method, Johnson distribution system and orthogonal transformation. With the created temporal rainfall pattern, frequency analysis, runoff analysis, and unsteady flow analysis is performed. And then, a reliability assessment with MFOSM method is performed regarding levee failure factors related to overtopping.

The use of stochastic rainfall generation technique, flood-runoff and reliability analysis in this study will contribute to the design and evaluation of hydrosystems. Furthermore, the methodologies presented in this study will be used to play a major role in the establishment of a nationwide flood disaster prevention system.

Keywords : Reliability, rainfall pattern, multivariate Monte Carlo, overtopping, levee, flood disaster prevention

References

- Ahn, K.H., Han, K.Y. (2009). "A Study on Generation of Stochastic Rainfall Variation using Multivariate Monte Carlo method", J. of korean society of hazard mitigation, Vol 9, No. 3, pp. 127-133.
- [2] Apel, H., Thieken, A.H., Merz, B., and Bloschl, G. (2006). "A probabilistic Modelling System for Assessing Flood Risks." Natural Hazard, No. 38, pp. 79-100.
- [3] Hill, I.D., Hill, R., and Holder, R.L. (1976). "Algorithm AS 99. Fitting Johnson curves by moments." Appl. Stat., Vol. 25, pp. 180-189.
- [4] Merkel, U. and Westrich, B. (2008). "PC-River Probabilistic Reliability Analysis for River Dikes." 4th Int. Symp. on Flood Defence, pp. 110-116.