

Application of LS-SVM Method in Probabilistic Stability Analysis of Saturated Soil Slopes

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Summary

To assess the stability of a soil slope considering uncertainty in soil characteristics (C , Φ), it is necessary to conduct repeated calculations to determine both the Factor of Safety (FS) and the Probability of Failure (PF). The absence of analytical solutions leads researchers to use surrogate approaches of probabilistic modeling. This study aims to assess the PF and FS of a saturated soil slope using one of the Machine Learning (ML) method subsets, the regression Least Squares Support Vector Machine (LS-SVM). The results are compared to those obtained from the Limit Equilibrium Method (LEM) to compare the accuracy of LS-SVM. According to the FS-PF plot, it is concluded that LS-SVM is a reliable tool for determining the stability of a multi-layered saturated soil slope, which significantly improves computational efficiency. However, to avoid false predictions, limitations must be removed. Therefore, each layer should be included in the analysis within its probabilistic distribution, so using this method is more efficacious in clay soils. In addition, training data are debated in terms of the percentage employed. Furthermore, the importance of dataset scattering is discussed.

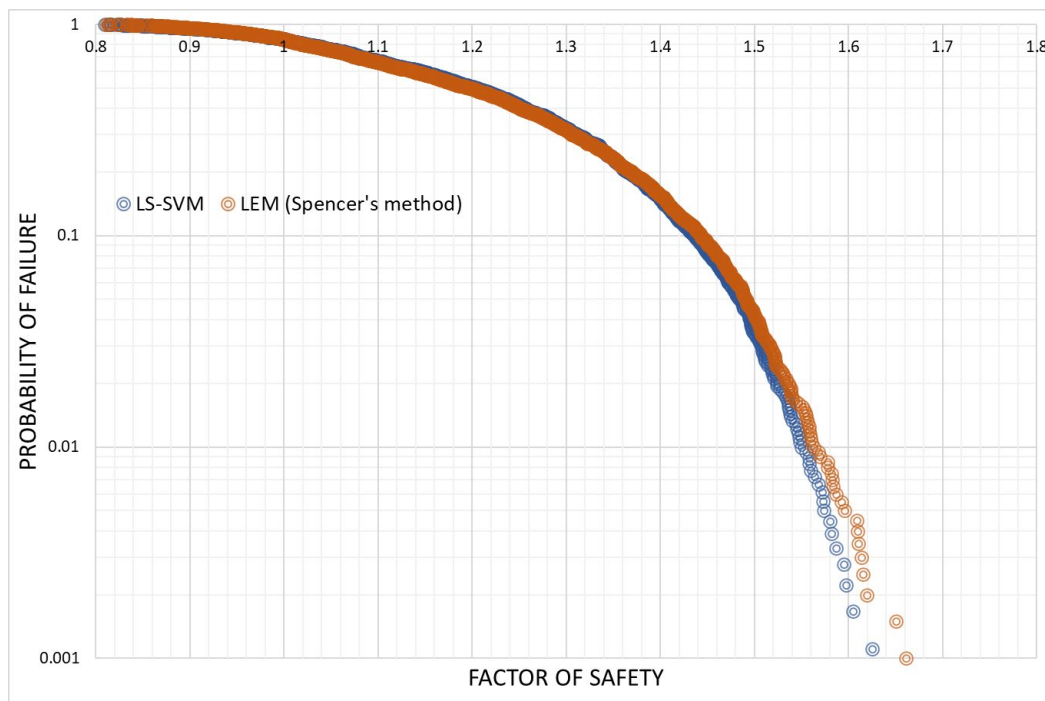


Fig.7. Comparison of PF- FS for saturated soil slope

Theory / Method / Workflow

This study aims to assess the PF and FS of a saturated soil slope using one of the Machine Learning (ML) method subsets, the regression Least Squares Support Vector Machine (LS-SVM). The results are compared to those obtained from the Limit Equilibrium Method (LEM) to compare the accuracy of LS-SVM. In addition, training data are debated in terms of the percentage employed. Furthermore, the importance of dataset scattering is discussed.

Results, Observations, Conclusions

According to the FS-PF plot, it is concluded that LS-SVM is a reliable tool for determining the stability of a multi-layered saturated soil slope, which significantly improves computational efficiency.

Novel/Additive Information

However, to avoid false predictions, limitations must be removed. Therefore, each layer should be included in the analysis within its probabilistic distribution, so using this method is more efficacious in clay soils. In addition, training data are debated in terms of the percentage employed.

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