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Probabilistic Slope Stability Analysis of Excavation Induced Landslides Using Hermite Polynomial Chaos

Authors : Schadrack Mwizerwa

Abstract : The characterization and prediction of landslides are crucial for assessing geological hazards and mitigating risks to infrastructure and communities. This research aims to develop a probabilistic framework for analyzing excavation-induced landslides, which is fundamental for assessing geological hazards and mitigating risks to infrastructure and communities. The study uses Hermite polynomial chaos, a non-stationary random process, to analyze the stability of a slope and characterize the failure probability of a real landslide induced by highway construction excavation. The correlation within the data is captured using the Karhunen-Loève (KL) expansion theory, and the finite element method is used to analyze the slope's stability. The research contributes to the field of landslide characterization by employing advanced random field approaches, providing valuable insights into the complex nature of landslide behavior and the effectiveness of advanced probabilistic models for risk assessment and management. The data collected from the Baiyuzui landslide, induced by highway construction, is used as an illustrative example. The findings highlight the importance of considering the probabilistic nature of landslides and provide valuable insights into the complex behavior of such hazards.

Keywords : Hermite polynomial chaos, Karhunen-Loeve, slope stability, probabilistic analysis
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