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Quantifying the Impact of Uncertain Material Parameters on Pavement Response using an Inverse Modelling Technique

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Abstract

Accurate modelling of pavement response plays a critical role in the effective design, analysis, and maintenance of road infrastructure. However, the presence of uncertainty in material parameters can significantly compromise the reliability and accuracy of such models. This study focuses on investigating the impact of uncertain material parameters on pavement response by employing an inverse modelling technique. The objective of this research is to utilize an inverse modelling approach to assess the influence of uncertain material parameters on Uzan's model, a commonly used model for pavement response. The study considers measured stress and strain values obtained from tyre and Falling Weight Deflectometer load conditions applied to granular materials. The inverse model is formulated as a nonlinear least squares minimization problem, in conjunction with a finite element model that analyses the deformation of flexible pavements. Through the application of the inverse modelling technique, this study aims to determine the extent to which uncertain material parameters affect the accuracy of pavement response predictions. By comparing the predicted pavement behaviour derived from the inverse model with actual measured data, the influence of uncertain parameters can be quantified. The outcomes of this research contribute to advancing the understanding of the complex interplay between material parameter uncertainties and pavement response.

Keywords: *Finite element modelling, Inverse problem, Parameter estimation, Pavement response*