

Development of a General Purpose Computer Programme Based on Differential Evolution Algorithm: An Application towards Predicting Elastic Properties of Pavement

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Abstract : This paper discusses the application of machine learning in the field of transportation engineering for predicting engineering properties of pavement more accurately and efficiently. Predicting the elastic properties aid us in assessing the current road conditions and taking appropriate measures to avoid any inconvenience to commuters. This improves the longevity and sustainability of the pavement layer while reducing its overall life-cycle cost. As an example, we have implemented differential evolution (DE) in the back-calculation of the elastic modulus of multi-layered pavement. The proposed DE global optimization back-calculation approach is integrated with a forward response model. This approach treats back-calculation as a global optimization problem where the cost function to be minimized is defined as the root mean square error in measured and computed deflections. The optimal solution which is elastic modulus, in this case, is searched for in the solution space by the DE algorithm. The best DE parameter combinations and the most optimum value is predicted so that the results are reproducible whenever the need arises. The algorithm's performance in varied scenarios was analyzed by changing the input parameters. The prediction was well within the permissible error, establishing the supremacy of DE.

Keywords : cost function, differential evolution, falling weight deflectometer, genetic algorithm, global optimization, metaheuristic algorithm, multilayered pavement, pavement condition assessment, pavement layer moduli back calculation

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