Efficient reevaluation of surface displacements in a layered elastic half-space

In situ evaluation of mechanical pavement properties requires fitting measured surface displacements with model displacements. Such inverse analysis is guided by optimisation algorithms that entail re-execution of the underlying model many times over. For layered elasticity, which is the most commonly employed pavement model, this involves calculating computationally demanding semi-infinite integrals in every optimisation step. In this connection, a method was proposed to improve the computational efficiency of surface displacement recalculations in layered elastic systems. It was based on manipulating the original integrals by adding and then subtracting carefully selected auxiliary functions so that they remained mathematically unchanged, yet became faster to compute. The auxiliary functions were derived from an analytic interrogation, rendering the formulation robust and applicable to any layered elastic system without practical restrictions on the model parameters. Overall, the method is deemed consistently more efficient than standard evaluation techniques for achieving a given accuracy level.