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A NUMERICAL APPROACH TO THE ANALYSIS OF FLEXIBLE PAVEMENTS

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ABSTRACT
The paper is centred on a numerical approach developed in the framework of the theory of plasticity and applied to the quasi-static analysis of viscous systems, with particular attention given to the case of flexible pavements. An internal variable formulation is considered and a computer method is developed, in which inelastic (viscous) strains represent the only unknowns. Next, it is shown that the solution of the mechanical problem corresponds to the minimum point of a convex function, say ω, which depends upon nodal displacements and internal variables. Thus, the solution may also be found by making use of mathematical programming or by exploiting a traditional prediction/correction procedure, which ensures (iteration after iteration) a progressive decrease of the convex function ω.

The proposed technique is applied to the analysis of flexible pavements, which represent rather complex structural systems, in which viscosity often plays an important role, since the stress state depends upon inelastic strains and the fatigue strength of bituminous layers is affected by their viscous response.

Finally, some numerical results are presented and potential applications of the approach proposed in the paper are discussed by considering two numerical tests. They are concerned with a simple test specimen subjected to a loading/unloading cycle and with an axi-symmetrical system, which represents a flexible pavement characterised by a bituminous, viscous layer.

KEY WORDS: Viscosity, plasticity, finite elements, convergence, pavements