ASSESSMENT OF THE HEALTH OF LEVEES USING SURFACE DISPLACEMENTS

By

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ABSTRACT

Implementation of long-term, continuous, and automated health assessment technology is imperative to ensure the reliability and safety of flood-control levee systems. Recent developments in sensing technology enable the continuous and cost effective remote and field monitoring of surface displacements of such systems. This study proposes a multi-stage technique to assess the health of levees based on displacements measured at the surface. Recorded displacements are used along with identification tools to localize and quantify the degree of degradation of internal zones in levees.

The proposed methodology characterizes the internal degradation of levees by: (1) localizing an evolving weak zone within a levee section, (2) quantifying parameters defining the degradation of the mechanical properties of the degrading zone, and (3) estimating the associated level of reduction in the levee's health. Localization of the evolving weakening zone in a levee is performed using a technique based on Neural Networks. Identification and inverse problem techniques are then used to quantify the extent and level of internal weakening and associated changes in strain energy. The health of the levees is quantified in terms of a factor based on the estimated state of strain energy and the ultimate energy capacity.

Computer simulations of levee systems were used to assess the capabilities of the developed techniques under various instrument configurations and analyzed system conditions. Displacement histories obtained from a centrifuge test of a levee model were used to examine the performance of the proposed algorithms with real soil systems data.