



**US Army Corps  
of Engineers®**

Engineer Research and  
Development Center

## **Phase Profilometry**

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**Description** At times the condition of surfaces or objects must be measured or evaluated, but traditional technologies are sometimes too invasive and may not be effective. A good example is the need to assess quickly the condition of airfield surfaces, where the use of a laser scanning system is cost prohibitive. A Phase Profilometry system provides a noncontact method for conducting these types of assessments inexpensively.

**Capabilities** The staff of the Information Technology Laboratory (ITL), ERDC, provides expertise in the design, development, and application of Phase Profilometry systems to support ERDC laboratories, Corps districts, and other government agencies.

**Supporting Technology** Phase Profilometry uses digital pictures of surfaces illuminated by periodic shadows to profile surfaces. An example of a periodic shadow is the shadow cast by light coming through a window blind. Changes in the surface elevations distort the shadows. This distortion can be used to determine surface elevations through computer processing of the digital image. Phase Profilometry has the potential for measuring pitting or cratering in concrete, wall deformations, water-surface wave interaction, and pavement deformations, among other things. It can be used for airfields and pavement evaluations, water-wave measurements, runway or bridge responses, structure and dam deformations, near-field topography (road surfaces), field sensors, automatic personnel recognition, and three-dimensional vision. The Phase Profilometry systems await being automated and standardized.

**Benefits** Phase Profilometry technology has potential for many practical applications – to measure pitting in concrete, evaluate airfields, determine runway and bridge responses, quantify structure and dam deformations, or automate personnel recognition. Tests to date have produced results that are accurate as well as cost and time effective. Phase Profilometry systems cost much less than laser scanning systems used for the same purposes. In addition, these systems have no moving parts, create no eye safety issues, and have the potential to provide near-real-time surface profiling and the profiling of fast-moving surfaces.

**Success Stories** ITL personnel collaborated with the Diagnostics Instrumentation Analysis Laboratory of Mississippi State University in applying Phase Profilometry to measuring concrete penetration craters. In another feasibility study, ITL staff demonstrated that Phase Profilometry could be used to measure the response of structures to terrorist or weapons attacks. More recently, they teamed with scientists in ERDC's Coastal and Hydraulics Laboratory to measure water-surface waves in a hydraulic model. ITL staff also demonstrated that Phase Profilometry could be used to measure road surfaces and profile the grooves in airfield runways.

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