



Integrating InSAR, tilt and GPS measurements for improved deformation monitoring

E. Davis, S. Marsic, W. Roadarmel
Pinnacle Technologies

GPS, Tilt and InSAR measurement technologies all have shortcomings that limit their application in deformation monitoring projects. Integration of all three measurement types allows many of these shortcomings to be mitigated and results in a measurement system that provides maximizes precision, breadth of coverage, long term stability, and fast response.

The performance regime of each technology is well established. GPS is ideal where absolute measurements are needed, where all three axes of motion are of interest, and when long term accuracy of results is a key requirement. InSAR is especially applicable where large areas need to be covered, ground instrumentation is prohibitively expensive, and deformation rates fall within its lower, yet respectable, resolution limits. Tilt is the only technology capable of both medium and very high precision measurements of the earth surface or structures.

Each of these technologies has several weaknesses that must be addressed for successful deployment. For example, GPS sites are relatively expensive and require open sky. Tilt often becomes impractical for monitoring areas larger than several square kilometers and loses its precision advantage over long periods of time. Since tilt measures the gradient of the deformation, instrument layout requires special attention and may compromise results if not implemented correctly. InSAR provides line of sight measurements rather than the full motion vector and is often limited in accuracy by variable atmospheric and ground conditions.

Integrating the different technologies, by using data from one set of tools to constrain the analysis of another, takes advantages of their respective strengths while partially

cancelling the weaknesses. The result is a more robust and accurate monitoring system that can meet design goals previously unattainable or attainable only at very high cost. The paper outlines the integration methods and provides examples of these systems using real data.