



## **Crustal deformation analysis from permanent GPS networks**

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The problem of the determination of invariant horizontal crustal deformation parameters from the analysis of coordinate series from permanent GPS networks is addressed with emphasis to some particular innovations: (1) Rigorous computation of maximum and minimum elongation factors and their directions, dilatation, maximum shear strain and its direction based on the singular value decomposition of the deformation gradient, instead of the classical approximations based on the infinitesimal strain approach. (2) Horizontal strain on the surface of the reference ellipsoid instead of its usual approximation by a plane. (3) Evaluation of the effect of realistic coordinate accuracy estimates on the signal-to-noise ratio of the estimated deformation parameters. (5) Interpolation of displacements or velocities by the classical finite element method, as well as by stochastic prediction thus taking also into account the effect of the interpolation error in addition to the velocity uncertainties on the final results. (6) Investigation of spatial discontinuities and introduction of the concept of regional discrete-Tisserant reference systems in order to identify and remove trends due to the rigid motion of subregions, which not contributing to deformation.

All relevant methodologies and computational tools are demonstrated by application to a particular region of the Japanese national network of permanent GPS stations.