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TO: Distribution

FROM: R. D. Reasenberg

SUBJECT: Combination of Saved Normal Equations which Were Generated Using Different Nominal Parameter Values

It is often both practical and economically sound to analyze data in small batches, at least initially. This having been successful, an analysis using larger batches or all of the data is a reasonable next step. If the problem has proved to be nonlinear (e.g., if it has been necessary to iterate on a linearized estimator), then the "best" solutions for the separate batches represent linear adjustments from a disparate set of nominals. (Nonlinearity is not the only possible reason for this condition to obtain.) The Saved Normal Equations (SNE) from these "best" solutions can not be combined directly, however, they can be combined (linearly) by a simple method given below.

Many examples of the need for a Disparate Parameter Saved Normal Equation Combiner (DIPSNEC) can be found. Among them are:

1. The Mariner 71 gravity analysis yielded 3 separate (sixth degree spherical harmonic) models each with a set of spacecraft state vectors for the associated spacecraft trajectory arcs. In the absence of a DIPSNEC, the individual gravity model coefficients were averaged over the three models, ignoring the differences in the covariances of the 3 solutions. The error associated with this procedure will become more severe for the Viking data analysis because of the availability of data taken with a substantially different planet/spacecraft geometry.

2. In preparing to generate a new ephemeris and solar system model, I find that: a) the classical optical data SNE and observation library (obslib) are referred to PEP Ephemeris 311; b) the planetary radar data SNE and

Application to PEP

Equation 10 provides the most direct way to change the nominal parameter values of SNE. A small external program or a PEP operating mode to perform this simple operation would be useful. However, the same results can be achieved by modifying an obslib tape according to equation 9, and then reforming the right hand side of the normal equations (U). The required adjustment, $x' - \tilde{x}$, can be put into PEP by forming a solution using only an a priori covariance and parameter vector. The PREDIC link will then perform the obslib modification.

The potential economic savings associated with the equation 10 method over the equation 9 method does not appear to justify the cost of implementing the former method.

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