APPLICATIONS OF SIMULTANEOUS GROUND-BASED AND SATELLITE OBSERVATIONS

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ABSTRACT. Simultaneous ground-based and satellite observations either of a body of the solar system or an external source, together with mutual observations between satellite and Earth observational sites could be used to monitor different reference systems.

1. GENERAL DESCRIPTION OF THE METHOD

We consider F and f, the functionals to optimize, where f depends on the following set of parameters: the terrestrial physical π_ϕ, the geometrical of the terrestrial system π_E and the geometrical of the considered system (for example, a net of artificial satellites) π_S . Analogously, the functional F also includes, implicitly, parameters related to the terrestrial motion in the inertial system Π_E, geometrical of the terrestrial system π_E and also physical π_ϕ. From the initial values $\pi^0_\phi, \pi^0_E, \pi^0_S$ we can obtain increments $\delta\pi^0_\phi, \delta\pi^0_E, \delta\pi^0_S$ minimizing the functional f. The previous process provides values, which we denote as $\pi^1_\phi, \pi^1_E, \pi^1_S$ which are the result of adding to the initial values the obtained increments.
These new parameters are included in the functional F where, in addition, we should consider the increments $\delta\pi^1_\phi, \delta\pi^1_E, \delta\Pi^0_E + \delta\Pi^1_E$ where we have usually a relationship between $\delta\pi^0_\phi$ and $\delta\Pi^0_E$, through a expression $g(\delta\Pi^0_E) = \delta\pi^0_\phi$. Then, we optimize the other functional F to obtain the corresponding corrections and then we return to the functional f until we obtain stationary values in the parameters.
To summarize, we consider a precision previously fixed, $\varepsilon > 0$ and the process may be described as:

Opt $F(\Pi^{[i]}_E + \delta\Pi^{i+1}_E, \pi^{i+1}_E + \delta\pi^{i+1}_E, \pi^{i+1}_\phi)$ subject to
Opt $f(\pi^i_\phi + \delta\pi^i_\phi, \pi^i_E + \delta\pi^i_E, \pi^i_S + \delta\pi^i_S)$
$g(\delta\pi^i_\phi) = \delta\Pi^i_E$
$\Pi^{[i]}_E = \Pi^i_E + \delta\Pi^i_E$
Stop if $\left\|(\delta\pi^i_\phi, \delta\pi^i_E, \delta\pi^i_S, \delta\Pi^i_E)\right\|_\infty < \varepsilon$
on the contrary
put $\Pi^{i+1}_E = \Pi^{[i]}_E, \pi^{i+1}_E = \pi^i_E + \delta\pi^i_E, \pi^{i+1}_\phi = \pi^i_\phi + \delta\pi^i_\phi$ and
Continue

We should remark that each problem usually includes the optimization (generally minimization) of a different discrete either continuous functional, defined by means of a succession of temporal data either a spatial distribution either both cases. In any case, the traditional methods of optimization (quadratic minimization) do not necessary work. We should pay a special attention to the distribution of the available data. Some particular cases are now been studied by the authors.

Acknowledgements. Part of this work was supported by grant P1-1B2009-07 from Fundacio Caixa Castello BANCAIXA and a grant GV/2009/027 from Generalitat Valenciana