

3.6.2.3 Forschungseinrichtung Satellitengeodäsie, Technical University of Munich (FESG)

Research Activities The research activities at FESG as a Combination Research Centre of the IERS can be divided into four major topics:

- Analysis and combination of sub-daily Earth Rotation Parameter (ERP) series,
- Analysis and combination of nutation series,
- Rigorous combination of ITRF, EOPs and ICRF,
- Study contributions of Lunar Laser Ranging (LLR) to the IERS products.

The work is done in close cooperation with the DGFI (Deutsches Geodätisches Forschungsinstitut, Munich, Germany), the GIUB (Geodätisches Institut, University Bonn, Germany), and the GFZ (GeoForschungsZentrum Potsdam, Germany), the major activities being funded by Geotechnologien-Projekt of the German BMBF (Bundesministerium für Bildung und Forschung) .

The research activities of the FESG CRC started in September 2001, when the corresponding funding was obtained.

Sub-Daily Earth Rotation Series

As a first step, time series of Earth Rotation Parameters (ERP: pole coordinates, UT1) from different space geodetic techniques with a sub-daily resolution have been analysed and compared to assess the quality of the sub-daily ERP estimates, especially for time series from GPS and VLBI. After analysing the individual solutions first tests on the combination of the sub-daily series of ERPs were performed. The most recent results of these analyses were presented at the IAG Symposium in Budapest in September 2001. As a final goal it is planned to

- (1) routinely generate combined ERP series with sub-daily resolution as a new IERS product to be used for studies in Earth rotation and geophysics,
- (2) to compute the amplitudes of the ocean tide effects on Earth rotation. Comparing and combining the amplitudes of different space geodetic techniques (GPS, VLBI, SLR, altimetry) an optimal model for the correction of semi-diurnal and diurnal terms caused by the ocean tides will be generated and made available to the IERS.

Nutation Series

We started to analyse in detail the series of nutation parameters determined by VLBI (Goddard Space Flight Center, NASA) and the series of nutation rates determined by GPS (CODE Analysis Center of the IGS, AIUB). Other techniques and analysis centres

will be included as soon as nutation or nutation rate series become available. From the analyses and comparison of the individual series we can get information about systematic effects between the different techniques. Combined nutation series could become a new product of the IERS in future. From the nutation series we may also compute the amplitudes of the most important nutation terms. These estimated amplitudes may be used to validate the present nutation models of the IERS.

Combination of ITRF+EOP+ICRF

The common and consistent combination of terrestrial reference frame (TRF) together with Earth Orientation Parameters (EOPs) and inertial reference frame (CRF) is a big field of research within the IERS and the FESG is contributing to develop new combination strategies. At the moment only TRF and EOPs can be combined with the available software, based on normal equations. The combination tests that were already done have been limited so far to intra-technique combination of GPS solutions from the different analysis centres, but the software package is presently being modified to work for an inter-technique combination using the local tie information and including a weighting strategy. Expertise gained from both research topics mentioned before, i.e., sub-daily Earth rotation series and nutation series, will be very beneficial to a rigorous combination of ITRF, EOPs and ICRF.

Contributions of LLR to the IERS Products

This research topic is performed in close cooperation with the IAPG (Institute for Astronomical and Physical Geodesy, TU Munich). The only LLR solution contributing to the ITRF2000 was produced by the FESG. With this CRC activity we plan to study in detail, to what extent LLR solutions may contribute to the various IERS products (station coordinates and velocities, EOPs, ...) and which additional information may be obtained from LLR solutions (as, e.g., relativistic parameters or tidal parameters). To perform these studies the current LLR software has to be updated to the most recent IERS standards and modified to allow the combination of the results (SINEX files) with those of other techniques. It is the goal to periodically produce LLR solutions as a contribution to the IERS products.

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