Moving-mass calibration of LCR-G gravimeters-
Determination of beam-position dependent transfer functions in the Mátyáshegy Gravity and Geodynamical Observatory, Budapest

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In this presentation authors propose a method for the determination of transfer characteristics and fine calibration of LCR relative gravimeters used for earth-tide recordings, by means of the moving-mass gravimeter calibration device of Budapest-Mátyáshegy Gravity and Geodynamical Observatory. Beam-position dependent transfer functions of four relative LCR G type gravimeters were determined and compared.
In order to make these instruments applicable for observatory tidal recordings, there is a need for examining the unique characteristics of equipments and adequately correcting these inherent distorting effects. Thus, the sensitivity for the tilting, temporal changes of scale factors and beam-position dependent transfer characteristics are necessary to be determined for observatory use of these instruments.
During the calibration a cylindrical ring of 3200 kg mass is vertically moving around the equipment, generating gravity variations. The effect of the moving mass can be precisely calculated from the known mass and geometrical parameters. The maximum theoretical gravity variation produced by the vertical movement of the mass is ab. 110 microGal, so it provides excellent possibility for the fine calibration of gravimeters in the tidal range.
The calibration process is aided by intelligent controller electronics. A new PLC-based system has been developed to allow easy control of the movement of the calibrating mass and to measure the mass position. It enables also programmed steps of movements (waiting positions and waiting times) for refined gravity changes. All parameters (position of the mass, CPI data, X/Y leveling positions) are recorded with 1/sec. sampling rate. The system can be controlled remotely through the internet.
Magnetic experiments were also carried out on the pillar of the calibration device as well, in order to analyse the magnetic effect of the moving stainless steel-mass. According to the magnetic measurements, a correction for the magnetic effect was applied on the measured gravimetric data series.
Because of the astatic geometrical configuration of the sensor its response varies in function of the position of the index beam. The moving mass calibration is an absolute method to determine the scale function (scale(index_position) = $\Delta_{gobs}/\Delta_{ref}$). Two independent methods were applied to determine the scale function, the minmax (the difference of extremes of observed g values is compared to the one obtained from theoretical calibrating signal, and the scale factor of the instrument can be derived as the ratio of the measured and theoretical differences) and full-fit method (fitting the g_{obs} to g_{ref} in the full range of calibrating signal using LSQ method*)*. The full-fit method characterises numerically the signal residuals (± 2 microGal) provided by the LSQ fit in function of the distance between the barycentre of the ring mass and the sensor.