A MOTORIZED SYSTEM FOR RAPID DEFLECTION OF VERTICAL DETERMINATION

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ABSTRACT. A specialized motorized system is constructed in order to provide a reliable system for quick astro-geodetic determinations, particularly, astro-geodetic deflections of vertical. The system consists of the following components: (1) A motorized theodolite, (2) a GPS sensor, (3) an atmospheric parameters sensor and (4) a notebook.
The system implements the equal zenith distances method. During the one hour field session, over one hundred of star passes are registered, when using the 45th almucantar. Because of the integration of the system, the result (vertical deflection components) can be calculated right on the spot.

1. INTRODUCTION

Astro-geodetic deflection of vertical components (ξ, η) are used as a control of gravimetric measurements, because they are obtained without assuming the density of the Earth. This motorized system is constructed in order to achieve 0.3" - 0.5" accuracy of the astronomic coordinates (Φ, Λ), within the one hour of a field session. The main requests for the system are the following:

- Creation of the observation program,
- Orientation of the theodolite,
- Placing the instrument in the star's direction,
- Precise time measurement, and
- Logging of the measurements performed during the session.

2. PRINCIPLE OF THE COMMUNICATION

The communication between the system components is organized by a special program written mainly in C++, with interrupts written in Assembler. The registration of the star pass is caught by an interrupt function, logging the notebook oscillator state. The tie between the oscillator state and UTC ticks is established by another interrupt, registering each 1PPS tick sent by the integration box (i.e. GPS sensor).

The hardware integration box consists of:

- GPS sensor with internal power supply (inside the box),
- 1PPS output port (BNC),
- Registration joystick input port (BNC), and
- 3 RS232 I/O ports (DB9).

The 1PPS port is not used here, but it is useful for testing the stability of the GPS sensor oscillator. The registrations of star passes are performed manually, using the joystick input port. One of the serial I/O ports is used for connection with the theodolite. Two other ports, besides the standard I/O facilities (TX and RX pins), use some other pins, in order to establish the tie between 1PPS and the joystick with the integration program, running on the notebook.

3. CONCLUSION

Using this kind of measurement system, one can expect the accuracy of astro-geodetic deflection of vertical components in the range of 0.3" - 0.5", within one hour of field measurement session. During that period, over one hundred of passes can be registered with manual registration.
Since the measurement system is very portable and easy to operate, during the one observation night three to four stations can be visited, if the stations are 5-10 km far away one from another. Due to the characteristics of the equipment and the logging system, the result can be obtained just a few minutes after the session.

4. REFERENCES

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