geomETH

Geodetic Metrology and Engineering Geodesy - Prof. Dr. H. Ingensand   *ETH Zurich*

Engineering Geodesy I   HS 2010
Exercise 2: Deformation Monitoring

Motivation & Goals:

A major task in Engineering Geodesy is the automatic monitoring of objects – such as the monitoring of dams, landslides or glaciers with total stations.

- create your own automatic deformation monitoring system
- use "GeoCom" commands to control a TPS 1200 station
- perform real time observations of objects (prisms)
- view the state of your objects online

Material: For each group are provided

- 1 Leica total station TCRP1201
- 1 Serial-USB adapter
- 1 Serial Cable with Leica interface
- Reflector Pisms

Instructions:

1. Set up your total station on a pillar or tripod.
2. Connect the instrument with a serial/USB interface to a PC (or to your laptop).
3. Set the following parameters at the instrument: (5) Configuration → (4) Interfaces → GeoCom Mode → Edit → Device (F5) → New
Now enter a new device name (F6 to switch between numeric and alphabetic), Baud-Rate: 19200, Parity: None, Data Bits: 8, Stop Bits: 1
Store (F1), Cont (F1). Use Interface: Yes. F1, F1 (back to main menu)
4. Create a Matlab program that prints out the current Hz- and V- readings from a total station. Use the file 'cricketcom.m' from last week or download from the website: www.geometh-data.ethz.ch/student/eg1/2010/01_sensors/cricket/cricketcom.zip
In order to use it for TPS data transfer, make the following changes:
a.) as a parameter in serial command set baud rate to 19200
b.) add `'Terminator','CR/LF'` as a parameter in serial command
c.) add `'Timeout',60` in serial command
d.) the string to be send to the instrument is `'%R1Q,2107:'`
e.) for each `fprintf` command to TPS use **always exactly one(!)** `fscanf` command
f.) turn unnecessary lines into comments using '`%`' at the beginning of a line
Example printout: `%R1P,0,0:0,0.765622235904042,1.615765282999877`

5. Extract the numeric values (hz- and vert-angle) from the string. Help is given in the film at: http://www.geometh-data.ethz.ch/student/eg1/2010/02_deformation/index.htm

6. Place a couple of prisms around you.
7. Let the instrument automatically find the prisms, using 'find next prism' (or 'power search') and 'fine adjust'. Send 'quick distance' and 'coordinate request' when telescope is aimed to target. Use each command for TPS together with these 3 lines:

```
fprintf(s, '%R1Q,2117:');   % quick distance (returns hz, v, slope dist)
out = fscanf(s)             % put return code into the string out
fprintf('quick dist: %s',out); % print response message on screen

'%R1Q,111:0'           switch on instrument
'%R1Q,2010:0,0,0,0'    sets instrument to coordinate origin
'%R1Q,2113:0'          sets instrument orientation
'%R1Q,9043:0.0,1.57,0.28,0.6,1' set search window (hz-,v-cent,hz,v,enable)
'%R1Q,9052:1,0'        starts power search
'%R1Q,9051:1,0'        finds next prism
'%R1Q,9037:10,10,0'    fine adjust to target
'%R1Q,2107:'           an angle request
'%R1Q,2117:'           distance (returns hz, v, slope dist)
'%R1Q,2116:'           coordinate request (returns ΔE, ΔN, ΔH)
'%R1Q,9027:hz,vz'      moves telescope to position hz, vz ([rad] but string)
'%R1Q,2008:0,0'        stop EDM
```

A detailed list of GeoCom commands and parameters is given in the manual:
http://www.geometh-data.ethz.ch/student/eg1/2010/02_deformation/TPS1200_GeoCOM_Manual.pdf
Use the search function to find a certain command, e.g. "2117" for Quickdistance.

8. Measure the local coordinates of visible prisms, store them in an array and plot them. Plotting dots on a 2D-grid is done by: `plot(xvec,yvec,'.','MarkerSize',15);`

9. Copy the current graphic (prisms.jpg) in a webfolder and use a web browser to view it. Online folder access: in windows explorer, right click *Netzwerkumgebung*, choose *Netzlaufwerk verbinden.* Use any drive letter, and type for folder (Ordner): engineering_geodesy auf "publish.webfarm2.ethz.ch"
\\publish.webfarm2.ethz.ch\engineering_geodesy
\\publish.webfarm2.ethz.ch\www_geometh-data\engineering_geodesy

This copies prisms.jpg directly in your online folder:
`saveas(gcf,'<drive letter>:\group<number>\prisms.jpg');`
The URL to view your picture reads:
http://www.geometh-data.ethz.ch/engineering_geodesy/group<number>/prisms.jpg

10. Enable continuous monitoring of the prisms using a loop. Instead of using 'find prism' all the time, consider the more efficient 'move telescope' command (9027).

11. Open an empty webpage in any editor and create a simple html file. Store it in your webfolder. Add the lines below in order to display the current target coordinates and a plot of the prisms.
<img src="prisms.jpg">
Data from a text file can be displayed with:
<iframe src="prisms.txt" width="300" height="500"></iframe>
Print your group number and some basic information on the webpage as well.

12. Let the website update every 12 seconds by adding the following line to the header: <meta http-equiv="refresh" content="12; URL=prisms.htm">