Update of BeiDou Education and Training

Beihang University
11 Nov. 2014, Prague, The Czech Republic
Introduction
Activities in 2014
GNSS education and training facility
Future plan
Beidou International Exchanging and Training Center is affiliated to China Satellite Navigation Office (CSNO) and established in Beihang University in August 24th, 2012. The center mainly serves for International exchanging and training on Beidou technologies.
Activities in 2014

- Degree Program in China
- Exchanging in Singapore
- Exchanging in Australia
- APSCO training in Indonesia
- Training in Morocco
- 3rd Summer School in China
## Degree Program

<table>
<thead>
<tr>
<th>Year</th>
<th>Participants</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>13</td>
<td>Bangladesh, Indonesia, Iran, Mongolia, Pakistan, Peru, Thailand,</td>
</tr>
<tr>
<td>2014</td>
<td>17</td>
<td>Indonesia, India, Iran, Nigeria, Mongolia, Pakistan, Spain, Thailand</td>
</tr>
</tbody>
</table>

2 participants were recommended by Nigeria Regional Centre and 2 participants were recommended by SGAC to join the MASTA program in GNSS 2014
Degree Program
Exchanging in Singapore

In Feb. 2014, FENG Wenquan, the director of BeiDou International Exchanging and Training Center, led a delegate to Singapore participate the International Innovation Fair and promote cooperation with Singapore partners.
BeiDou Application and Cooperation is one of major topics, WENG & YANG participated the forum.
Discussion on the cooperation with Australian government for BeiDou Applications
In August-September 2014, APSCO organized GNSS Application Training Course in Jakarta, Indonesia. Our center invites Professor Yang Dongkai, Jin Tian and QIN Honglei from Beihang and ZHANG Lei from BIT, SHEN Jun from CSNO as the lecturers.
Training in Morocco

4-day GNSS/BeiDou Courses for Morocco Regional Centre (July 6-9, 2014)

- Beidou introduction and its applications
- Beidou ICD introduction
- Beidou Signal simulator design
- GNSS receiver signal processing experiment (including orbit, spread spectrum code, acquisition, tracking, positioning, etc.)
- Practice on the data collection in the field.
The 3rd BeiDou/ GNSS Summer School on GNSS Frontier Technology organized by CPGPS and BeiDou International Exchanging and Training Center, hosted by TongJi University on July 28 - August 1, 2014 in Shanghai, China
Education and Training Facility
Smart classroom

Support by MOE & CSNO
Teaching ➔ Collaborating
Small-class-based teaching

- Small scale classroom provide better score
- Traditional class has about 100 students
- This room supports 18~36 students

(Glass, G.V.)
Collaboration and Discussion

• During discussion, students will improve
  – Knowledge Basis
  – Thinking Ability and Brain Storm
  – Communication Capability
  – Scientific Spirit
Collaboration and Discussion

• From PASSIVE to ACTIVE study
Courses on GNSS technology

<table>
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<tr>
<th>Course</th>
<th>Class Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSS Reference System</td>
<td>18</td>
</tr>
<tr>
<td>Principle of Global Navigation Satellite Systems</td>
<td>32</td>
</tr>
<tr>
<td>GNSS Navigation Signal</td>
<td>18</td>
</tr>
<tr>
<td>GNSS Receiver Principles and Design</td>
<td>32</td>
</tr>
<tr>
<td>GNSS/INS Integration Navigation</td>
<td>32</td>
</tr>
<tr>
<td>Global Satellite Navigation System Applications</td>
<td>18</td>
</tr>
<tr>
<td>Satellite Navigation Data Processing</td>
<td>32</td>
</tr>
<tr>
<td>GNSS Experiment</td>
<td>18</td>
</tr>
<tr>
<td>GNSS New Technologies</td>
<td>18</td>
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</tbody>
</table>
GNSS software on system level

Orbit analysis
By selecting a satellite, the system can provide an orbit with its height, radius, and other parameters. In addition, the system can export trajectory on Earth for each satellite and each GNSS system, GPS, BeiDou, Glonass, and Galileo.
The software demonstrates the signal transmission process from the ground stations to the satellites, which generate the carrier signals and broadcast to the earth. The users got the signals from at least four satellites could calculate its positioning information through signal acquisition and tracking.
GNSS software receiver

Antenna
- Antenna Gain
- Antenna Pattern
- Standing Wave Ratio
- Anti-Jamming

Signal Process
- Signal Acquisition
- Signal Tracking
- Signal Decoding
- Filter Algorithm

Signal Analysis
- Time Domain
- Frequency Domain
- Eye Diagram
- Consistency Analysis

Application
- Beidou Application
- Beidou IC Chip
- Beidou Product
GNSS software receiver

GUI of the software receiver
GNSS software receiver

- Spread Spectrum Modulation (E2-3)
  - Understand the spread spectrum modulation
  - Study the generation methods of Beidou signal
Students can obtain acquisition and tracking results and algorithm performance by setting related parameters, for example DLL and PLL bandwidth, correlation coefficients, damping ratio for tracking and searching space, threshold for acquisition.
Integrated experiment platform

Including the following experiments:

1. Sky view
2. Positioning excursion
3. Satellite location calculation (BeiDou and GPS)
4. Satellite pseudo range and carrier phase calculation (BeiDou and GPS)
5. Receiver location and GDOP resolution
6. GDOP real-time resolution
7. View of SNR and satellite elevation (BeiDou and GPS)
8. Transformation of Cartesian coordinates and Geodetic coordinates
Integrated experiment platform

Software interface
Massive Open Online Courses (MOOC)

The GNSS courses will be distributed in the website, the lecturers and students could discuss online / offline and even the test and examination.
Virtual Lab

The satellite navigation virtual lab is built up in the data server, the navigation system and distant control software to realize remote control of system and data to provide the users practice based on the real data and environment.
We consider putting GNSS knowledge and technologies into textbooks for primary and middle school students.
Thank you!

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