Monthly Meeting (April 2020)

Date: April 28, 2020
Time: 2:15pm - 3:16pm
Location: Park Seismic Office
Attendees:
In the office: Choon Park and Jin Park
Via Skype: Josefin Starkhammar and Nils Ryden

The meeting started with Choon's greetings to team Sweden. We talked about the changes in weather: the longer daylights they have these days and the beautiful Yellow Flowers in the fields in Sweden. We also talked about our lifestyles under COVID 19 lock-down, etc.

Topics regarding Administrative work

1. We will use SLACK as the main communication tool from now on. The HMA blog will remain active, and Jin will continue to maintain it. We will use the blog as a storage of materials and logging purposes. It will be used as its original purpose, i.e., a "web log."

2. Team Sweden (Josefin Starkhammar and Nils Ryden) has been limited by the university policy with the COVID-19 in their work progress during the last couple of months. Now everything related to the old system ("SYS-RYD-2019") has been brought to their home office from the University (LTH), and so both can now work freely at home. Enhanced progress is expected to be made now with less limitations and regulations being imposed.

Topics regarding Technical work

1. Hardware construction (Jesefin Starkhammar and Nils Ryden)

    - Josefin started building the acquisition system by using the hardware components procured by the budget provided in late March. The analog-to-digital (AD) converter is the first device being built for a total of 64-channel system.
    - Once this AD converter is ready, then the cables and receiver array (a 48-channel MEMS microphone array) from the old system ("SYS-RYD-2019") can be connected to test this part of the new system ("SYS-HMA"). Then, further field tests will be made to collect data sets at a newly built HMA road nearby Lund, Sweden. The results will be used to finalize the configurations for the new receiver array (e.g., optimum number of channels, channel spacing, connecting multiple microphones, etc.). One set of the new array will be built afterward.
    - The new AD converter will be different from the old one in several aspects. First, it will have much lower sampling rate (e.g., 100 kHz) than the old one (16 MHz).

Second, it will have a higher number of maximum channels (96 channels) than the old one (48 channels). Third, it will be more compact in its size and weight. Lastly, it will be equipped with a higher performance computer.

- The new system will have additional sensors; i.e., GPS and IR temperature sensor. Sufficient number of USB ports will be installed to the system for these and more additional sensors that may be necessary in the future. The GPS accuracy will be within +/- 1 meter.
- Analog filter was briefly discussed among all investigators. Choon asked about the triggering mechanism and raised the potential issue of false triggering made by strong ambient noise. Josefin (and Nils) commented that's why analog filters (both low-pass and high-pass ones) are so critical, especially at the low frequencies that may come into the system as strong noise. Considering the common thickness range we will deal with (e.g., 5-15 cm) and corresponding frequency ranges of signal seismic waves (e.g., 10-30 kHz), the two analog filters (i.e., low- and high-pass ones) should be specified properly at the very early stage of the AD converter.
- Choon also asked about the mechanism of amplifier in the AD converter in relation to the possible connection of multiple MEMS microphones to make one channel for the purpose of attenuating impact-generated sound waves. Josefin replied it is very important to know the typical voltage range of incoming analog signal to fully utilize a given dynamic range in the AD converter (e.g., 12-bit). Although it was properly set through intensive test for the old system, similar tests will be made for this new system. The increased dynamic range (16-bit) will allow a bigger tolerance in output digital signal regardless of the amplifier setting.

2. Methodology

- Choon asked about the temperature dependency of HMA in its stiffness (i.e., seismic velocity). He expressed a potential reduction in the final evaluation accuracy (Vs and H) due to the complication introduced by the temperature dependency.
- Nils responded that although there is such temperature dependency, it can be almost ignored within the frequency range we will mostly deal with (e.g., 10-30 kHz). We will present the final results in context. For example, it can be stated like "this HMA's seismic velocity (Vs) is measured as 1500 m/s at 25 °C for a representative frequency of 20 kHz."
- He also responded that although the temperature dependency makes things more complex, it is not to the level that can jeopardize the overall effectiveness of the approach.
- Choon briefly discussed quality of the data set collected by using the old system last October at a university (LTH) parking lot. He commented that the reason why these data sets did not show good dispersion trend at useful frequencies (e.g., > 10 kHz) might be due to bad quality of the asphalt at the parking lot

and/or too thin layer (e.g., < 5 cm). Nils responded it might be more due to the bad quality.

- Choon responded he is still analyzing those 10 "best" data sets from the parking lot among all (about 300) data sets acquired at the time (including false-triggered ones).

Agreed to do:

1. Josefin will prepare and provide the April invoice package by the next weekend (5/8).
2. Team Sweden will try to collect more HMA field data sets by using the old ("SYS-RYD-2019") system soon.

The meeting adjourned at 3:16 pm.