

Andrii Murdza



- *PhD student at Thayer School of Engineering, Dartmouth College*

Principal supervisor: Prof. Erland M. Schulson

Co-supervisor: Prof. Carl E. Renshaw

UNIS supervisor: Prof. Aleksey Marchenko

Title of the project: Cyclic loading of ice

Cyclic loading of ice

Motivation

In nature ice is commonly subjected to a dynamic cyclic loading, for example, ice cover deflects up and down due to the wave/tidal action, or when ice cover serves as a road in winter. A number of instances have been reported where, a floating ice cover exhibited sudden breakup into pieces much smaller than the peak wavelength (Asplin and others, 2012; Collins and others, 2015). In both cases, a rapid swell built up after the breakup and the fractured cover had almost no effect on damping wave energy, opposite to the case with a solid cover. Ice breakup leads to a greater wave amplitudes and intensifies melting. Therefore, an important question is raised, i.e. how cyclic loading affects the strength of ice (Murdza and others, 2019).

Experiment

For a better understanding of how natural cyclic loading affects the flexural strength of ice covers, we conducted a series of laboratory experiments on natural freshwater lake and sea ice at UNIS cold rooms. Lake ice was taken from the lake located near mine 7 in Longyearbyen, Svalbard. Sea ice that we used was taken in March 2019 from landfast ice in Svea. Large ice blocks (~120 x 70 x 50 cm) were cut and then transported to UNIS cold room (Figure 1). Firstly, specimens were roughly cut in the shape of beams to the required dimensions with a chain and band saw. Later, using massive metal plates, specimens were melted to the dimensions of $h \sim 45$ mm in thickness, $b \sim 10$ mm in width and $l \sim 600$ mm in length (Figure 2). Figure 3 shows a sample while testing and Figure 4 shows a surface of a sample after it has failed.

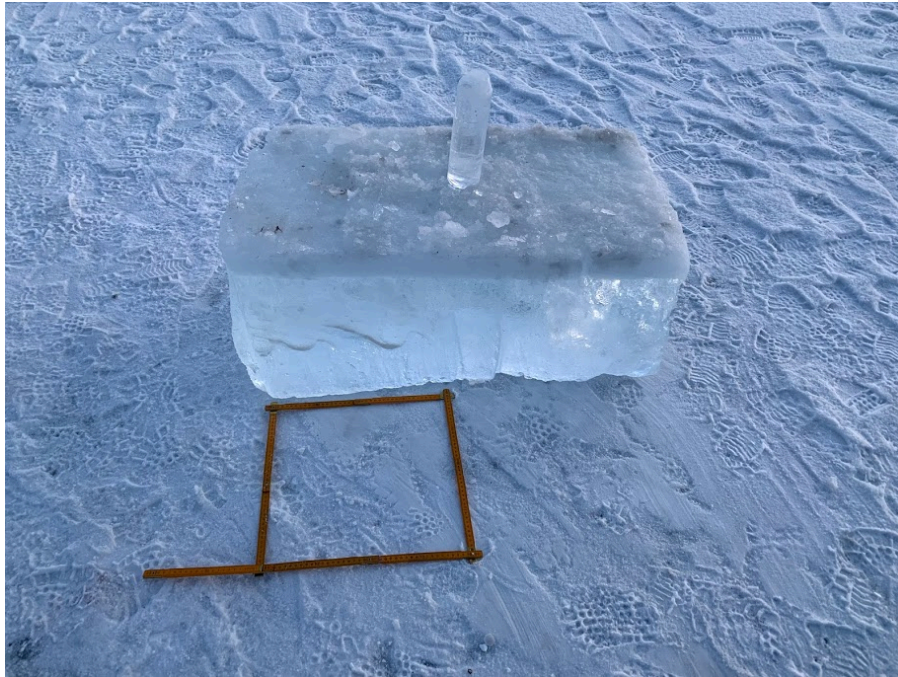


Figure 1. Freshwater ice block that was cut from the lake ice cover and then transported to UNIS cold laboratory.



Figure 2. Prepared freshwater ice sample before testing.

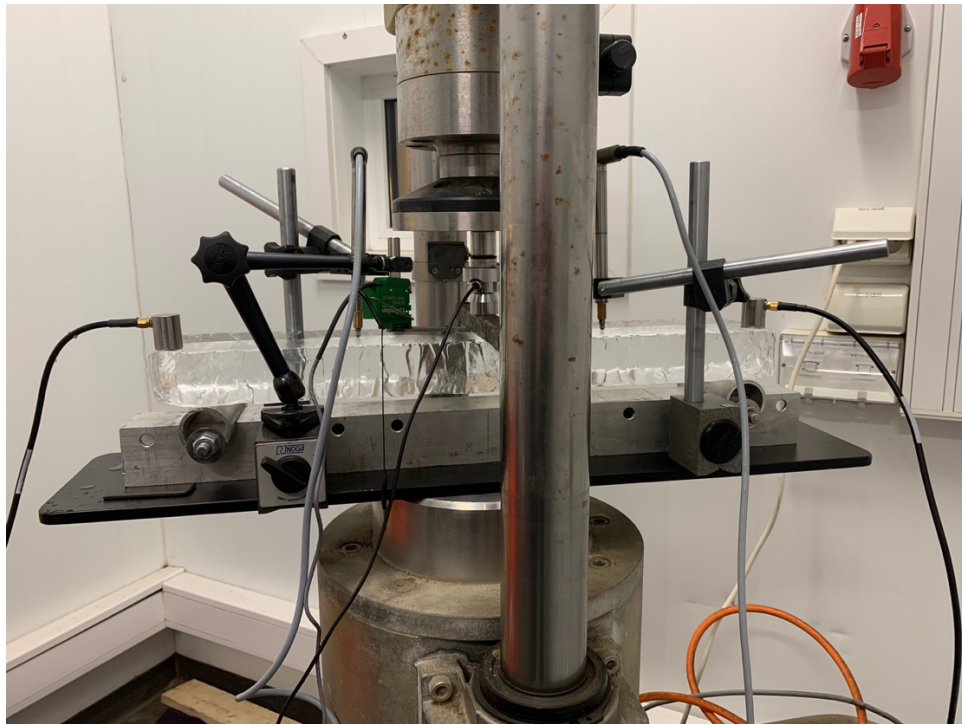


Figure 3. Setup of cyclic loading experiment.



Figure 4. Ice sample after failure.



Figure 5. Fractured surface of a broken sample.