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ABSTRACTS OF PAPERS PRESENTED AT THE SYMPOSIUM BUT NOT PUBLISHED IN FULL IN THIS VOLUME

A MECHANICAL TEST PROCEDURE FOR AVALANCHE SNOW

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Abstract. The design, construction and testing of a portable, constant strain-rate testing machine for determining the mechanical behavior of avalanche snow is described. The machine is intended for use in determining the stress–strain–time behavior of low-density natural snow in the field. A technique for making direct measurements of strain in the snow sample is described and stress–strain curves are presented for strain-rates ranging from 0.5 to $5.0 \times 10^{-5}\ s^{-1}$. The densities of the snow samples tested range from 186 to 335 kg m^{-3}. Ultimate-strength data and relaxation curves are also presented.

DISCUSSION

In the absence of the authors, questions were answered by R. A. Sommerfeld.

T. Lang: The claim is made in the paper that strain-rates of the order $10^{-8}\ s^{-1}$ can be imposed. It would be helpful to show that rates of this order can be handled by the instrument, particularly in measuring the physical deformation constants.

R. A. Sommerfeld: The gearing of the machine would allow strain-rates of $10^{-8}\ s^{-1}$. Very low deformation rates may require some special techniques because of the long times involved.

PLANE-STRAIN COMPRESSIVE STRENGTH OF COLUMNAR-GRAINED AND GRANULAR-SNOW ICE

By R. Frederking
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Abstract. An ice cover impinging on a long straight structure is assumed to be under a condition of plane strain. A technique is described for performing plane-strain compression tests, and results are presented for the strain-rate dependence of strength. The plane-strain compressive strength of ice having anisotropic structure (columnar-grained ice) is at least two and a half times the uniaxial compressive strength, whereas the plane-strain compressive strength of ice having an isotropic structure (granular-snow ice) is at most 25% greater than

the uniaxial case. The greater plane-strain compressive strength of columnar-grained ice, when the loading and confining directions are in the plane of the ice cover, can be attributed to its anisotropic structure, which leads to a different failure mechanism for the plane-strain case.

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DISCUSSION

P. R. Kry: Do you think a lubricant such as silicone oil would reduce friction on the side restraining plates?

R. Frederking: Kerosene and some other light oils reduced the friction. We did not test silicone oil.

A. J. Gow: You mentioned that you used columnar ice with horizontal *c*-axes. Did you attempt to manufacture ice samples with *c*-axes vertical? In our studies of lake ice in New Hampshire we found that the *c*-axis vertical structure is much more common than the *c*-axis horizontal structure.

Frederking: No, we could grow ice with horizontal *c*-axes in the laboratory but could not make reproducible samples with vertical *c*-axes.

J. W. Glen: In your graph for granular-snow ice the curves for uniaxial and confined strengths crossed, implying that in some range confined strength is less than unconfined. Do you believe this represents a real situation? Surely unconfined strength must always be lower.

Frederking: This is an artefact of our least-squares fitting method. It may be significant that the curves approach each other at the low strain-rates.

BEARING CAPACITY OF FLOATING ICE SHEETS

By M. D. Coon

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Abstract. Floating ice sheets are loaded thermally as well as mechanically by winds, water currents, and at times by man-made structures. When floating ice sheets are to be used in engineering problems, all of the applied loads must be accounted for. Determining the forces that will cause an ice sheet to fail is difficult not only because of the various kinds of loads, but also because the properties of ice sheets (fresh and sea) are dependent upon many variables, and the properties vary through the thickness of the ice sheet.

To illustrate the bearing-capacity problem, the equations for a beam are considered, including an example of the variations of ice properties through the thickness of an ice beam. The physical behavior of the ice enters the problem through two systems of equations: one which relates the force and deformation of an ice sheet, and the second which is a statement of the stress state which will cause the ice sheet to fail. A full understanding of how the equations depend on such variables as temperature and brine volume are crucial to an understanding of how the applied loads cause the ice sheet to fail.