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Ice Load Prediction During Indentation

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INTRODUCTION

The extraction of hydrocarbon resources from the Arctic in an economical and safe manner poses many technical challenges to offshore engineering. At the root of these problems is the severe environment created by perennial ice features that impart global forces and local pressures on structures that are several times greater than those from waves in non-Arctic environments. Typically, two levels of ice loading are considered for design purposes. Global ice loads govern the overall structural geometry and dimensions as well as the foundation design, while local ice pressures dictate wall thicknesses and local framing, and may well govern structural cost. It is widely recognized that significant uncertainties exist in current ice load prediction models and that some design loads may be over-estimated by an order of magnitude.

Uncertainties in existing ice load models arise primarily from five sources:

- Incomplete knowledge of the mechanical behavior of ice, including temperature and fracture behavior.
- Empiricism in existing theoretical models resulting from the use of approximate analysis methods.
- Inadequate modeling of the contact forces at the ice-structure interface.
- Neglecting the effect of scale/size on material strength.
- Not accounting for the finiteness of environmental and other forces driving the ice features.