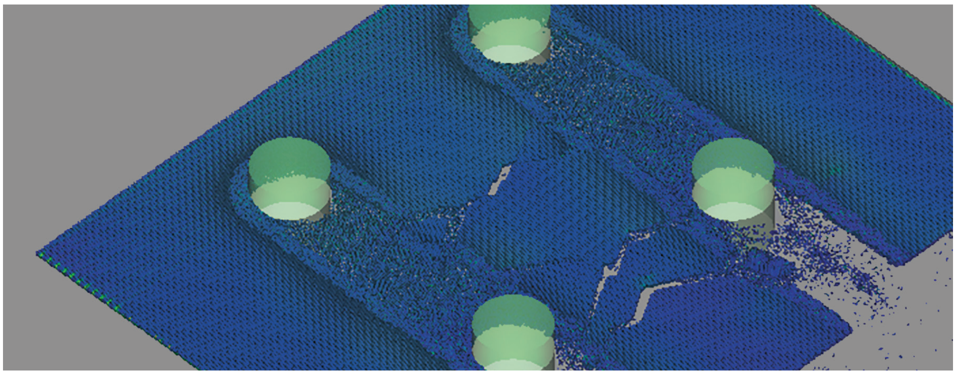
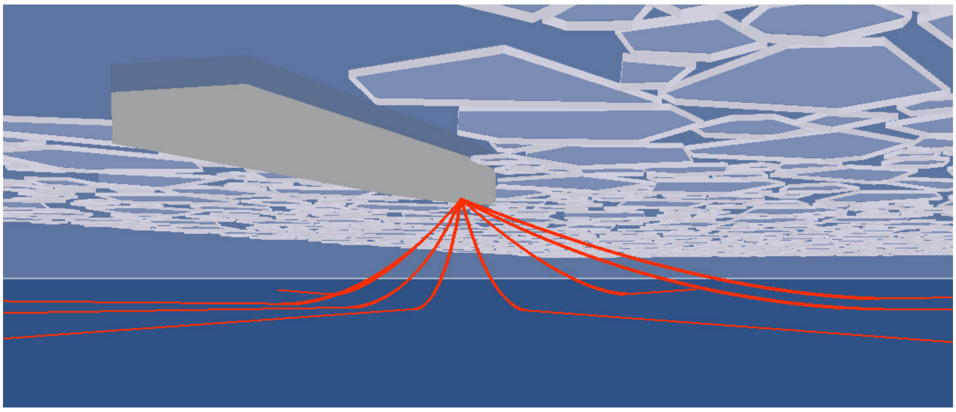
ARCTIC TECHNOLOGY DEVELOPMENT

ABS envisages that simulation technology will play an increasingly important role in future design and operational decisions. We continue to invest in the development of numerical and analytical tools for practical simulation of ships and offshore structures in ice. Two promising high fidelity numerical technologies developed with ABS support include the Discrete Element Method (DEM) and GPU Event Mechanics (GEM) simulation. ABS is also leading an effort to develop a methodology for evaluating structural risks of non-ice strengthened and light ice class ships in operating marginal pack ice conditions.





DISCRETE ELEMENT METHOD (DEM)

DEM is a high fidelity numerical tool capable of realistic 3D simulations of ice-structure interaction. ABS has partnered with Clarkson University and Dalian University of Technology to develop the tool which is deployed on a parallel computational platform. The model utilizes bonded spherical particles for the ice with representative strength parameters to solve complicated ice-structure interaction problems. Example applications include ice actions on multiple jackup legs and ice loads on floating offshore structures. The DEM tool is capable of cross-coupling of ice loads to finite element structural models or to mooring system models. This capability allows ABS researchers to create a numerical ice tank to analyze complicated problems and develop effective solutions.

GPU EVENT MECHANICS (GEM) SIMULATION

ABS has been working closely with researchers from Memorial University of Newfoundland (MUN) and other collaborators on the development of the GEM simulation technology for several years. GEM is a novel approach to numerical simulation of ships and offshore structures in pack ice conditions that has tremendous potential as a practical engineering tool for enabling a better understanding of harsh environment risks. Unlike continuum mechanics, which focuses on the fine mechanical detail of material behavior, event mechanics allows modelling of complex problems as a series of discrete events. This simulation approach allows engineers to evaluate the performance of ships and offshore structures in various ice conditions at hyper-real-time simulation speeds. ABS is currently leading an effort to verify and validate the software tool and its technical results against available field and model-scale data. Current applications include ship maneuvering in pack ice and station-keeping performance analysis of moored floating structures in various ice concentrations. GEM's capabilities are turning "design-by-simulation" into a reality.

VISION-BASED INTELLIGENT ICE NAVIGATION

One potential downstream application of GEM is the integration of vision analysis, radar imagery, and lidar data with the simulation technology. ABS and MUN researchers are investigating the possibilities of using GEM to provide real-time collision avoidance and near-field route optimization guidance on the bridge of a ship based on forward-feed input of the prevailing ice conditions.

ICE TECHNOLOGY FOR GOVERNMENT VESSELS

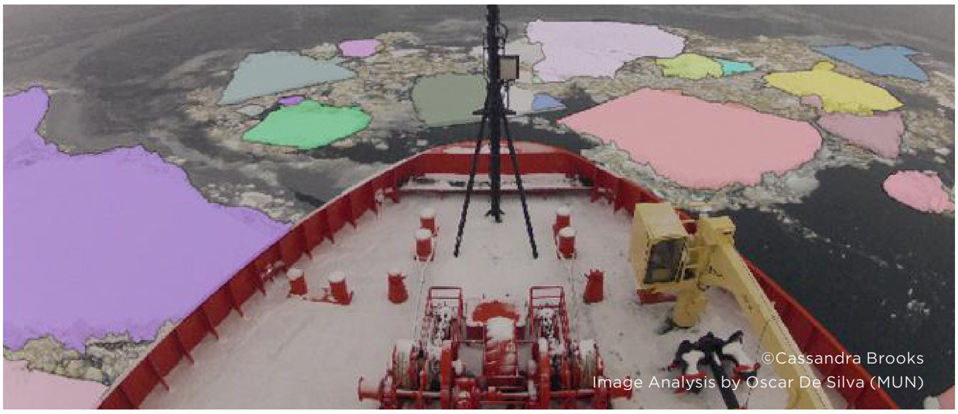
Governments have responsibilities to maintain an active presence in the Polar regions throughout the year despite a limited fleet of icebreakers and high ice class assets. This requires capabilities to support defense and national security missions in the region with non-ice class and light ice class ships with potential for operations in the marginal ice zone. ABS is leading the development of state-of-the-art technical analysis methodologies for evaluating structural capabilities of non-ice strengthened and light ice classed ships in various ice conditions. ABS and its partners, with support from the US Coast Guard (USCG), the Office of Naval Research (ONR), Transport Canada (TC), and Defense Research Development Canada (DRCD), are addressing new questions about naval vessels in pack ice, ice loads on ships considering structural compliance, and thin-ice failure mechanics. ABS can apply this technology to a variety of ship types to conduct risk and consequence analysis for accidental scenarios in pack ice conditions.

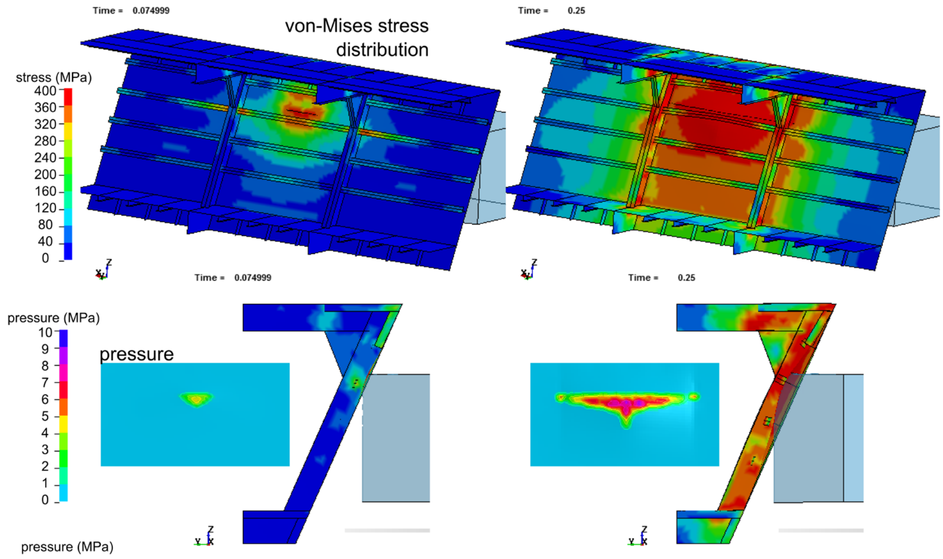
ARCTIC OFFSHORE STRUCTURES DEVELOPMENT

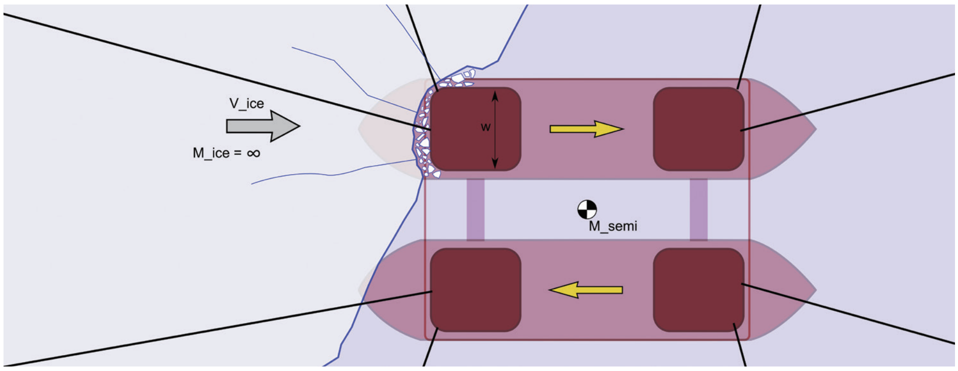
ABS is working with industry and research partners towards the development of certification and approval regimes for ice capable offshore structures in sub-Arctic regions in response to specific inquiries about ice capable semi-submersibles and ice capable jackups. In the NL offshore, for example, drilling contractors have on occasion suspended operations due to pack ice incursions. The cost for operators to disconnect mooring lines, move off location, and then reconnect on-site is significant. ABS has procedures in place to develop approvals in principle (AIP) for novel concepts such as ice capable mobile offshore drilling units (MODUs). We are working to develop a standardized methodology to evaluate structural capability and station-keeping performance of MODUs under design ice conditions.

ABS HARSH ENVIRONMENT TECHNOLOGY CENTER (HETC)

The ABS Harsh Environment Technology Center (HETC) was established on the campus of Memorial University in St. John's, Newfoundland and Labrador in 2009. The primary objective of the HETC is to develop technology for the design and assessment of ships and offshore structures that operate in harsh environments – particularly the Polar regions and low temperature areas. It is an extension of ABS' robust Polar and harsh environment program located within ABS' Technology department headquartered in Houston, Texas. Newfoundland was considered a prime location to establish an Arctic research center due to its excellent educational program, offshore oil exploration and development activities in the region, and progressive approaches in supporting research activities.







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