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E.V. Karulin, M.M. Karulina, L.B. Blagovidov. **Model studies of the caisson-type platform and ice interaction in shallow waters.** Pp. 5–21.

This paper contains results of the model studies on interaction between ice and upgraded platform «Shelf-7» in shallow water conditions typical for northern part of the Caspian Sea, where this platform is supposed for operation. Upgraded platform is a caisson structure having rectangular shape and inclined side planes in the zone of interaction with ice, which is installed on the sea bottom. Model studies carried out in the Krylov Institute's ice towing tank have revealed the sea bottom effect on the process of broken ice piling formation in front of the platform and variations in total ice load on the platform. When ice pile touches the sea bottom it could lead to decrease or increase of the total ice load on the platform. Decrease of the ice load is governed by the fact that some energy of the moving ice formation will be transferred to the sea bottom and increase of the ice load could be expected due to increase of internal stresses within the underwater broken ice piling imposed by a solid sea bottom boundary. These two phenomena were discovered during model studies on different stages of the platform – ice interaction: first, at initial stage of the ice piling formation, when its draft is close to the water depth the load increase was observed and at steady process stage, when stationary broken ice piling has formed in front of the platform, the load decrease was observed. Quantitative evaluations of the load increase and decrease are imposed by contact of piling keel with sea bottom and are obtained experimentally.

Main part of the model studies was carried out in the mode corresponding to the full-scale conditions when ice field is moving to the fixed platform model. Some part of the test scope was carried out using conventional model towing method in the fixed ice field. In both cases equal ice conditions were simulated (geometric and strength characteristics and drift speed) and water depth. This allows comparing experiment data obtained during realizations of these two modes of model test. Rather close coincidence both in qualitative patterns of platform – ice interaction and in values of measured ice loads is one of the main results of the performed studies, which evidences absence of the experiment mode effect on obtained results.

A.V. Bitsulya, K.E. Sazonov. **Development of the calculation formulae to determine minimum power of the main engines for ice-going vessels.** Pp. 22–42.

This paper describes development of the calculation formulas, which determine minimum power of the main machinery for ice-going vessels with ice class LU1-LU7. Authors use known relation between propulsor thrust and its power consumption to determine required power of the main engines. Propeller features are taken into account through diagrams of the propeller series tests. In order to determine thrust it is assumed as equal to the ice resistance. Authors examine various scenarios of the ice conditions for vessels of different RMRS class to determine ice resistance. Authors propose final formulae for calculations of the minimum power.

E.A. Dorokhova, K.E. Sazonov. **Investigation of the asynchronous ice breaking and turning processes on ice resistance.** Pp. 43–51.

This paper examines the effect of asynchronous processes of ice breaking and turning by the ship hull on resistance of the ice cover to ship movement. To consider asynchronous process effect the authors use non-autonomous mathematic model of the ship movement in level ice. As a result of numerical calculations authors obtain relations illustrating variations of ice resistance in time domain. Ice resistance is determined through averaging of these relations over relatively large time period. The data obtained in this manner are compared with results of ice resistance calculations using autonomous mathematical model. It is demonstrated that asynchronous processes of ice breaking and turning have significant effect on calculated value of the ice resistance.

P.N. Zvyagin. **Method for evaluation of strain gauging study results.** Pp. 52–61.

This paper describes original method for comparison of the full-scale experiment results with strain gauging of the hull deformations and a priori known reference functions simulating ship hull impact against ice. The algorithm provides researcher with a set of parameters, which characterises correspondence of the recorded data to the selected reference functions. The advantage of the given method over multi-layer artificial neuron networks is «transparence» of procedures for obtaining required parameters.

Described method could be applied for processing and interpretation of the full-scale data.

M.P. Lobachev. **Possible effect of air bubbling system on ship ice resistance.** Pp. 62–66.

This paper describes one of the possible mechanisms of the air bubbling effect on ship ice resistance. Examined mechanism is based on analogy between systems with gas lubrication and operation of the air bubbling system. It is assumed that air bubbling is able to generate enough air in gaps between submerged ice blocks and ship hull, which will be able to decrease friction between hull and ice. Qualitative coincidence of the proposed hypothesis with full-scale experiment data is shown.

V.A. Belyashov, N. Y. Klementieva, M.P. Lobachev, N.A. Ovchinnikov, K.E. Sazonov, L.G. Tschemelinin. **Investigation of the efficiency for hydro washing devise installed on the arctic ice breaker.** Pp. 67–77.

This paper presents results of investigation carried out in order to determine efficiency of a hydro washing devise, which consists of two bow propellers, on the advanced arctic ice breaker. Device efficiency is evaluated basing on analysis of the model experiment results that are performed in hydrodynamic and ice towing tanks and theoretical calculations as well. The hydrodynamic towing tank is used to determine characteristics of the hull flow conditions with propeller jets as well as correction factors for bow propeller – hull interaction. The ice towing tank is used for investigation of the hydro washing device effect on the ice resistance. Potential possibility of the underwater hull cleaning from submerged ice with jets from bow propulsors is estimated.

V.A. Zuev. **New technologies in ice cover breaking and navigation period extension using air cushion vehicles.** Pp. 78–96.

This paper describes technologies for application of the ACV to break ice cover and extend navigation period. It provides detailed description of two approaches in operation of the ACV: break ice cover at small and high speeds of the ACV when resonance oscillations of the ice appear. The paper presents data of the full-scale experiments, which validate the efficiency of these technologies. Also this gives proposes recommendations for selection of the design characteristics important for operational properties of the ACV.

A.V. Marchenko. **Simulation of the hummock consolidation and melting.** Pp. 97–138.

This paper describes a thermodynamic model for seawater hummock consolidation and melting. This hummock is simulated by mixture of broken pieces and water, which is characterised by effective density. A mathematical model takes into account the 3-D crystallization of the ice inside the hummock and salt diffusion in the seawater as well. Main equations of the model are based on the principle of the internal energy conservation and equilibrium conditions between temperature and salinity of the liquid phase. Numerical calculations of consolidation and melting are performed for the hummock of realistic shape. Evaluation of the hummock consolidated layer and thermal flow into the atmosphere through hummocked ice surface is performed.

N.A. Krupina, N.V. Kubyshkin. **Bending strength of the drifting one-year level seawater ice in the Barents Sea.** Pp. 139–159.

In recent decade (1996–2006) Research & Development Institute of Arctic and Antarctic has been carrying out ice research expeditions in the Barents Sea. These expeditions have brought a large scope of experience regarding bending strength of the drifting one-year seawater ice (120 tests of the consoles on the float, numerous tests with small specimens – cantilevers and discs). This paper presents results of data analysis for a case with level ice, which is performed for south-eastern and north-eastern areas of the Barents Sea individually. Effect of different ice characteristics (structure, temperature, total sponginess, brine volume) is investigated. Also relation between large-scale bending strength of the ice cover that is obtained through console test results and strength determined through tests of the small specimens is analyzed. Considering that most authentic approach in determining ice bending strength is tests of the consoles, which are sawed out over all ice thickness, and that these experiments are most labour-consuming, authors try to obtain empiric relations between ice physical properties, small specimen strength and large-scale bending strength of the level ice.

A.A. Skutin. **Model of iceberg drift and estimation of its underwater part shape effect on drift characteristics.** Pp. 160–170.

This paper proposes mathematical model for the iceberg drift under effect of wind and currents. Results of model experiments, which were carried out in order to determine iceberg resistance coefficients, are described. Three boundary shapes of the iceberg underwater part are investigated: cylinder, cone and prism. Calculation results of iceberg drift characteristics with selected shapes of the underwater part are presented. Calculations are compared with full-scale experiment data.

V.F. Kulepov, Y.A. Dvoychenko, A.L. Malygin. **Floating ice-cutting machines for operation on the ice cover of rivers and coastal sea areas of the Arctic shelf.** Pp. 171–190.

This paper evaluates matters related to development of floating ice-cutting machines, which are meant for operation on ice cover of rivers and at shelf area of the freezing seas. Through calculations authors have obtained efficiency relationships (speed of ice cutting) for all components of the ice-cutting machine parameters, which are equipped with various types of the actuating device. Also this paper provides data of full-scale test results for floating ice-cutting machine.

V.V. Lukovnikov, A.N. Chetyrkin. **Analysis of the classification society requirements to the installed power of the ice-going ships and application of these requirements to the ship design.** Pp. 191–206.

In this paper authors evaluate the requirements of various classification societies to the specification of minimum power for the main machinery of active ice-going ships. The paper contains calculations as applied to the

existing ships under present requirements. The obtained results are compared with power data of the existing ships. Authors conclude that these requirements are overstated.