FOURTH SOVIET - POLISH CONFERENCE ON NONCLASSICAL PROBLEMS IN THE THEORY OF ELASTICITY, KIEV, NOVEMBER 25-27, 1975

V. T. Grinchenko

This Fourth Conference was organized by the Institute of Mechanics, Academy of Sciences of the Ukrainian SSR, and was held November 25-27, 1975, in Kiev. The Polish group was headed by the Vice-President of the Polish Academy of Sciences, Academician W. Nowacki. The delegation included 13 Polish scientists representing scientific centers in Warsaw, Poznan, and Lodz.

The conference opened on November 25, 1975, in the Conference Hall of the Institute of Mechanics, Academy of Sciences of the Ukrainian SSR. The session was opened with an address by the Director of the Institute, Dr. I. Ya. Amiro. In his introductory address, Academician Nowacki emphasized the importance of Polish-Soviet scientific collaboration in the advancement of mechanics.

During the three days of the conference, 24 papers were read and discussed; of these, 11 were presented by Polish workers and 13 by Soviet ones (7 papers from Kiev and 1 each from Moscow, Riga, Rostov, Kharkov, Donetsk, and Tbilisi). These papers are summarized below.

Academician W. Nowacki (Warsaw) gave a paper entitled "Distortion problems for a micropolar elastic medium," in which he examined the behavior of a micropolar continuous medium with initial strain dependent on position and time. The corresponding system of equations was formulated, and variational principles were derived to provide a general approach to solving detailed problems.

Professor Z. Olesjak (Warsaw) gave a paper "Some cracking problems involving gas temperature and pressure," which was concerned with the quasistatic behavior of a crack in an elastic body filled with liquid or gas. The temperature and pressure may increase on account of cyclic variation in the volume of the cavity. This approach extends the application of the energy treatment to crack-propagation problems.

A joint paper by N. A. Kil'chevskii, Academy of Sciences of the Ukrainian SSR, Candidate D. I. Il'chishina, and L. M. Shal'da (Kiev) was entitled "The nonclassical theory of collision," which dealt with a revised formulation of the collision of elastic bodies. It was shown that the effects of surface waves give a better concept of the collision that does Hertz's classical theory.

Associate Member of the Ukrainian Academy of Sciences, V. L. Rvachev (Kharkov), gave a paper on "Logic-algebra methods in mathematical physics and programming automation in field calculation." The author has developed methods of constructing a special class of functions, which provides a general technique for incorporating information of a geometrical character in problems in mathematical physics. This method provides a basis for formulating and solving programming-automation problems, particularly with the object of quantitative analysis of states of strain and stability in thin-walled structural elements.

A paper by J. Bauer, J. Gierlinski, W. Gutkowsky, and E. Iwanow (Warsaw) was read by Professor W. Gutkowsky, and this surveyed researches on methods of calculation for two-layer coated rods. Particular attention was given to the scope for optimizing such structures by solving the problem for a special type of continuous medium. A means of deriving a reasonably optimal design was indicated.

A paper entitled "A nonclassical formulation of strain in layered orthotropic shells" was presented by Dr. Ya. M. Grigorenko and Candidate A. T. Vasilenko (Kiev), and was read by Ya. M. Grigorenko. This dealt with the derivation of basic equations in the theory of layered anisotropic shells of variable rigidity, including incorporation of transverse shear. The algorithms have been adapted for computer use for shells of...
rotation. This quantitative analysis facilitates comparison of exact solutions, solutions from the proposed theory, and those from the classical Kirchhoff-Love theory. The comparison indicates the ranges of variation in the elastic parameters within which refined theories are required.

Associate Member of the Academy of Sciences of the Ukrainian SSR, I. I. Vorovich (Rostov-on-Don), presented a paper "Mixed dynamic problems in the theory of elasticity for seminfinite regions." This gave a formulation of boundary-value dynamic problems for regions of wedge-layer type. Some general theorems proved by the author have been used to examine the qualitative features of stress distributions in such regions in relation to oscillation frequency. The behavior of the solutions at infinity was examined, and also at points where the nature of the boundary conditions changes, which led to demonstration of principles of limiting damping and stationary phase.

The paper by Professor Z. Weselowski (Warsaw), "Propagation of a strong tension wave in an elastic material," gave a general formulation of this problem, which is one in the behavior of elastic media under heavy loads. The situation is such that the amplitude has a marked effect on the wave propagation speed. An approach was presented that allows one to consider this aspect and to examine, in particular, the response of a prestressed elastic body to a dynamic load.

Dr. J. Kubik (Poznań) gave a paper "Some comments on the determination of thermal stresses due to moving thermal loads," which surveyed researches in dynamic aspects of thermoelasticity. An analysis was presented of certain erroneous results, together with a correct formulation of boundary-value problems for mobile thermal loads. The scope for using Green's functions to construct solutions was discussed. In addition, the effects of heat-source speed on the stress distribution in an elastic medium were examined.

Dr. E. Kosecka (Warsaw) gave a paper on "Motion of point defects," which dealt with motion of various types of dislocations in an anisotropic elastic medium. The theory of surface defects has been used to derive the expressions for the motion of a point defect and the force between a defect and an external field. A linear approximation was presented for the fields represented by longitudinal and transverse waves generated by a mobile defect. It was shown that the force due to the interaction between two point defects is zero in this approximation.

Associate Member of the Academy of Sciences of the Ukrainian SSR, A. N. Guz', and Candidate F. G. Makhort and I. O. Gushchi (Kiev) presented a paper on "An acoustic method of stress determination for bodies," which examined the scope for acoustic determination of a biaxial state of strain. The method employs laws established by the authors for the propagation of small-amplitude waves in prestressed bodies. Methods were given for determining the physical characteristics of materials required in quantitative interpretation of data on acoustic-wave propagation. It was stated that the method has been tested under laboratory and industrial conditions. Detailed examples were given of residual stresses determined in this way.

Professor A. L. Gol'denveizer (Moscow) gave a paper "The relation between the physical rigidity of a shell and the mathematical concept of surface rigidity," in which it was shown that there is incomplete correspondence between the concepts of physical rigidity and mathematical rigidity. In order to overcome the conflicts arising in various practical cases, the author introduced the concept of pseudoelasting. This has been applied to the deformation of thin shells, and it has been found that major conclusions on the frequency spectrum of an elastic shell formerly accepted are correct only if the boundary conditions for physical rigidity are met.

Professor Cz. Wozniak (Warsaw) gave a paper on "The mechanics of flexible bodies." This dealt with the mechanics of flexible bodies as a special division of the mechanics of continuous media. The characteristic features of flexible bodies are incorporated via the concept of stress nodes. The principle of additional virtual work was demonstrated for this continuous medium. Some consequences of the theory were presented, which may prove of value in the mechanics of flexible rods and moment free shells.

Academician V. D. Kupradze, Academy of Sciences of the Georgian SSR, Tbilisi, gave a paper on "Some nonstandard problems in the theory of elasticity," which surveyed the latest results on boundary-value problems involving homogeneous coupling. It was shown that these results extend the basis of solution of static and dynamic problems in thermoelasticity.

Associate Member of the Ukrainian Academy of Sciences, V. T. Troshchenko (Kiev), presented a paper "Trends in the inelastic deformation of metals under cyclic loads," which presented measurements on fatigue in a large number of metals under cyclic loads at 10-15 Hz. The metals were classified in