COMMENTS ON THE ARTICLE OF Ya. A. KAMENYARZH "A MODEL OF A STRENGTHENED PLASTIC MATERIAL"

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The paper of Ya. A. Kamenyarzh [1] contains remarks apropos of my article [2].

I wish to start with the fact that I am in agreement with the overall conclusion of the author of the note to the effect that the work is still far from complete.

The article discusses only part of the questions related to the complex trajectories of the stress, in particular, with different repeated loads and with rotation of the axes of the tensor of the loading. This is connected with the limited amount of experimental material at my disposal, as well as with the absence at that time of an adequate microscopic theory, which would have made it possible to determine the change in the models with different trajectories of the stress using a more limited number of experiments. Questions of the deformation of the original isotropic material are also not discussed.

In general, I believe that it is hardly possible to construct a theory which, based only on the data of one experiment, for example, on the curve of the simple elongation, will make it possible to calculate the deformation with any number of complex trajectories of the stress. During the process of plastic deformation, with complex trajectories of the stress, there can be changes in the structure of the material which are different from those which take place with simple elongation of an originally isotropic sample. The problem thus reduces to a gradual broadening of the class of loads, with a minimum of the required experimental data. It is not known when this problem can be considered as completed. This point of view was always expressed by A. A. Il'yushin, and was implemented practically in his work and the work of his followers. I also share it.

At the same time, I would like to clarify certain concrete remarks.

Note to Sec. 1. The fact that the deformations, calculated in two infinitely close paths of the loading, differ by a finite amount in the example given in [1] is not surprising, since these paths separate two different states of the material, complete and incomplete plasticity. An analogous situation holds when the trajectories of the loading are located on two different sides of a surface separating the regions of active loading and complete unloading.

Note to Sec. 2. Using the relationships given in [2], it is always possible to construct the surface b) and to demonstrate that this surface has an angular point. An analysis of the experiments points to the existence of angular points [3]. The surfaces a) and b), as the simplest experiments show, do not generally coincide. They are approximately superposed to simplify the theoretical formulations. This is not always admissible.

With the establishment of a dependence between the increments of the stresses and the increments of the plastic deformations in [2], geometric constructions, connected with a previously given loading of the surface, were actually not used.

Note to Sec. 3. I did not, in the general case, verify the satisfaction of the relationships, by which A. A. Il'yushin and D. A. Draker express their overall physical principle. However, the correctness of the use of the Draker integral in the example given in [1] is doubtful. Deformations in the neighborhood of the point P at the loading surface are being considered. If the point M is not a point with an arbitrary stress in the elastic region, far from P, but a point which is really attainable during the process of unloading (in [1], with unloading $\Delta T_{12} \leq 0$, $\Delta T_{23} \leq 0$), it can be seen that, in the example under consideration, the Draker integral is not negatively. (Compare the use of the Draker principle in [4, 5].) The Il'yushin integral has a completely concrete physical meaning, and the Il'yushin inequality is far less limited than the Draker inequality. The assertion made in [1] necessarily demands an example. It was most interesting.

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Note to Sec. 5. In [2] the experimental and starting data for the calculations are given in such a form that anyone can verify the calculations and satisfy himself on the degree of convergence of the results. A comparison of the calculated and experimental data was made in [2] by comparing the deformations with a given stress. The usually used comparison of the difference in the stresses with a given deformation seems to me inadmissibly rough. A difference of a few percent in the stresses can, using this method of evaluation (with a flat curve of the strengthening), correspond to divergences of several times in the increments of the deformations.

LITERATURE CITED

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