Preface to the Russian edition

High reliability of engineering structures and optimization of the technological process parameters depend to a great extent on the availability of the appropriate information on physicomechanical properties of the materials used.

In recent years, a great body of data has been accumulated on standard mechanical characteristics of materials of various classes and corresponding literature has been published which makes the work of a design engineer somewhat easier. However, these data cannot satisfy the ever growing requirements on the reliability of strength analysis, particularly for those structural elements which are subject to a variety of mechanical and thermal loads responsible for the complex stress state of the material. Intensive studies of the regularities of deformation and fracture of materials under conditions of a complex stress state are under way both in the Soviet Union and abroad. They are aimed at the development of scientifically justified codes for strength and reliable methods for predicting the deformability and ultimate state of critical elements of engineering structures. These investigations yield extensive factual data used efficiently not only by designers in their practical work but also by researchers engaged in the development of phenomenological models of the mechanics of deformable solids. Numerous requests from factories, design bureaus, and research institutions for the results of testing particular structural materials or for respective publications addressed to the Institute for Problems of Strength of the Ukr. SSR Ac. Sci., where the most sophisticated methods have been developed and the required equipment for testing materials has been designed and manufactured, testify to the topicality of this information.

This Handbook is the first attempt to systematize the results of the aforementioned investigations and to present them in a form (plots, tables) convenient for use. Testing of materials under complex stress conditions involves considerable procedure-related difficulties due to restrictions imposed by the design of specimens, loading schemes and regimes, and due to the virtually complete absence of industrial testing equipment. In addition, no unified terminology and notations have been established, and what is more, the data on the materials and types of tests given in the literature are not comparable in volume and classes. This explains the specific arrangement of the basic reference material in the book. To facilitate its perception, at the beginning of the book the authors give a brief survey of the main issues of the mechanics of a continuum pertaining mainly to the theory of stress and strains, and describe strength criteria and methods of material testing at a complex stress state.

The reference material is fully based on the results of the investigations performed in our country, particularly those performed by the authors during the past 15 years at the Institute for Problems of Strength of the Ukr. SSR Ac. Sci. This is partly explained by the fact that foreign publications refer to structural materials which are practically not used in the mechanical engineering in our country.

Wherever possible, the information is presented in the form in which it appeared in the primary source. When selecting the data, the authors faced essential difficulties connected with bringing them to a single system of units and making the terminology and notations consistent. We were not always successful in finding out the degree of accuracy of the results given in the primary sources. Therefore, some of the published data obtained with equipment not instrumented properly were not included into the Handbook. The authors' choice was also based on the practical value of the data with special emphasis on the results of short-term static tests

under conditions of simple loading. In some cases, the test regime (e.g., under conditions of static or dynamic fatigue) was specified. To make the presentation of the material concise, all the explanations, including the description of testing equipment and procedures, are reduced to a minimum. However, the system of references in the tables and captions to figures makes it possible to obtain additional information if necessary.

The reference data are compiled by classes of materials (see Section 2: cast irons, carbon steels, etc.). The summary index (see Table 4), wherein these data are systematized by grades of materials, gives the numbers of figures and tables containing information on the regularities of deformation, plasticity, and strength of materials under complex stress conditions, as well as the literature sources from which this information has been taken and where the testing equipment and procedures used for obtaining the corresponding experimental data are described.

In accordance with the State standard GOST 8.310-78, the data presented in this Handbook fall into the category of reference data.

The authors are far from believing that the choice of the structure of this book is the best. They recognize that some important experimental findings may have been inadvertently overlooked, and new data are being generated.

The authors will be grateful for any remarks and suggestions regarding improvements and additions.

The authors