

Preface

The objective of this book is to provide the readers with a working knowledge of dynamic experiments with a Kolsky bar, also widely known as a split Hopkinson pressure bar (SHPB). Kolsky bar has been extensively used for the characterization of material properties at high rates, where the results are a family of stress-strain curves with the strain rate as a parameter. Unlike quasi-static experiments for constitutive responses of materials, there is no standard approach currently available to measure the responses at high rates of deformation. Consequently, inconsistencies may exist in the results generated from different laboratories, with different bars, and by different operators. This book provides practical guidelines to design and perform Kolsky-bar experiments. The focus is on the improvement of experimental consistency using methods that facilitate the specimen to deform under desirable valid testing conditions. This book is not an extensive review of the Kolsky-bar technique. A number of review articles are available in literature. Rather, this book illustrates the design, execution, evaluation and application of Kolsky-bar experiments in details.

The presented topics start with the general concepts and fundamental principles of the Kolsky bars; followed by the design guidelines for various types of Kolsky-bar experiments; ranging from compression experiments on brittle, soft, and ductile materials; to experiments under multiaxial compression and at high/low temperatures; to tension/torsion experiments; as well as to intermediate strain rate experiments. Finally, the use of Kolsky bars for structural experiments are outlined. For each type of experiments, the design principles are introduced, critical issues are outlined, detailed examples are illustrated, and selected experimental results are summarized.

This book is the outgrowth of class notes developed for senior/graduate level classes on Dynamic Behavior of Materials at The University of Arizona, Purdue University, and a short course, Kolsky Bar, taught for the Society for Experimental Mechanics (SEM) at 2009 SEM Annual Conference and Exposition on Experimental and Applied Mechanics. Due to the detailed levels of the materials presented in this book, the selection of the examples is mostly from the authors' own research experiences. However, we present the design guidelines and experimental setup for each class of Kolsky-bar experiments with a general sense such that the readers can utilize this book to design his/her own experiments per their specific requirements.

The authors are very fortunate to have the opportunities to focus their research on this specific area for an extended period of time. This is not possible without the guidance from our mentors, the long-term support by funding agencies and the collaboration/assistance by colleagues

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Split Hopkinson (Kolsky) Bar
Design, Testing and Applications

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