Preface

The ongoing development of mechanical engineering relies on engineers' ability to design, shape, and adapt materials for demanding industrial and external conditions of use. The special edition presents a collection of studies that explore innovative materials manufacturing and treatment processes, modelling, and performance analysis of their properties and behaviour in different conditions.

Chapter 1: Modelling of Alloy Forming and Stamping focuses on computational and experimental approaches to analysing forming processes. It examines how alloy composition, deformation mechanisms, and process parameters influence the final geometry and mechanical performance of formed components, achieving greater precision and material efficiency simultaneously.

Chapter 2: Additive Manufacturing highlights the synthesis of alloys and steels, process optimisation, and some post-processing procedures essential for achieving necessary functional properties.

Chapter 3: Ultrasonic Welding explores a joining technique that is increasingly used for joining lightweight and dissimilar materials. The studies emphasise the joint properties and mechanisms of ultrasonic welding optimisation.

Chapter 4: Mechanical Behaviour and Extreme Environmental Response of Advanced Materials investigates how cutting-edge materials perform under extreme mechanical, thermal, and chemical conditions. It provides insights into deformation mechanisms, failure resistance, and adaptation strategies essential for applications in many sectors.

This special edition is a valuable resource for researchers and engineers involved in developing advanced materials and innovative processing technologies.