Preface

The high velocity impact of solid bodies has attracted a large amount of research over the past century by both military and civil engineers. These impacts, at hundreds to thousands of meters per second, involve large deformations of the impacting bodies which can result in their total destruction around the impacted area. The impact of projectiles on armored vehicles (at 1–2 km/s) and the impact of meteorites at space stations at (10–20 km/s) are areas of much interest in this field. At impact velocities of a few meters per second, the structural response of the bodies is the relevant issue for safety engineers in the automotive industry. In order to study the effects of high velocity impacts, a special scientific discipline has been developed over the past 50 years, termed the dynamic response of solids to impulsive loading. This field involves several different disciplines such as: elasticity and plasticity theories, hydrodynamics, high pressure physics, material response to at high strain rates, fracture mechanics, and failure analysis. Several symposia dedicated to these issues were established during the last decades, such as the Hypervelocity Impact Symposia series, the International Symposia on Ballistics, the APS conferences on Shock Compression of Solids (in the US) and the DYMAT conferences in Europe. In addition, several journals specifically dedicated to this field were established, such as the International Journal of Impact Engineering, since 1983, and the International Journal of Protective Structures (launched in 2010). All of these activities are focused on the dynamic response of solids to impulsive loading, by developing new experimental facilities and diagnostics, as well as advancing numerical simulations and analytical modeling.

This book is focused on the subject of terminal ballistics which deals with the interaction between a moving object (the threat) and a protective structure (the target) at impact velocities in the range of a few hundreds to a few thousands of meters per second. At these velocities the damage induced in the target is local, extending laterally to several projectile diameters, but it is concentrated along the direction of projectile's motion. Thus, the target can be either perforated as is the case for thin targets, or deeply penetrated (for thick targets). These penetration/perforation issues are important for the armor engineer who looks for ways to minimize the extent of damage to the protected structure. Similarly, the anti-armor designer is concerned with the improvements in the lethality of the threats by increasing their velocities, masses etc. The field of terminal ballistics covers a large range of scientific challenges and engineering applications, and we had to limit the number of the subjects which are discussed in this book. Naturally, most of the subjects we chose belong to armor issues, on which we worked for many years at the terminal ballistics laboratory in RAFAEL, a defense related research institute in Israel.

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