Preface

The aim of this book is to present a collected source of recent knowledge to graduate students and researchers working in the field of blast loadings and their effect on material and structural failure. This book covers experimental, numerical, and analytical aspects of material and structural response to dynamic blast loads and their mitigation.

Since dynamic blast loading problems are challenging, there is a paucity of mechanics- and physics-based solutions to mitigate the effect of these loadings on structures. The nation has a large, intricate, varied, yet vulnerable infrastructure system that is in turn composed of several smaller systems. The requirements to protect such a complex system and its components from a threat, including an explosive threat, can be examined in terms of systematic *resiliency*. Resiliency here is defined as the ability of a threatened system to prevent, sustain, and recover functionality in time, preferably very rapidly, after successful execution of the threat. Thus, a more resilient infrastructure is better able to recover from both natural and man-made disasters, is less susceptible to disruption, and is, ultimately, less attractive to attack. The material improvements for mitigation should be optimized across as wide a range of threat and vulnerability configurations as possible to improve a structural system's overall resiliency.

The idea for preparing this book originated as a result of two workshops on "Blast Mitigation" organized at the University of Rhode Island in 2009 and 2010 under the sponsorship of the Department of Homeland Security. The thrust of these workshops was in identifying areas of research, yet unexplored, and in recognizing hurdles that hinder progress in the field of blast mitigation.

The presentations at these workshops addressed various means of mitigating explosive threats through the study of composites, as well as a better understanding of construction materials, scaling, blast phenomenology, and of structural and system performance in response to blast loading. As a result of the workshop, several data gaps were identified and some are listed below

- Blast overpressure dampening by utilizing water mist or other methods.
- Development of resilient self-healing materials.

- Understanding failure mechanisms in and developing engineering failure models for novel composite blast-resistant materials.
- Development of novel metallic and composite sandwich structures for energy absorption and structural integrity under blast loading.
- Understanding structural collapse mechanisms, including the effect of elevated temperatures on structural steel, and developing numerical codes to predict structural collapse.
- Understanding key material attributes that improve the response of structures under simultaneous blast and fragment impact.
- Understanding the shattering of glass and developing glass that is both blast resistant and energy efficient.
- Understanding stress wave scattering and attenuation due to particulates for better dampening and channeling of energy.
- Addressing scaling issues to take lab experiments to full scale.
- Development of expendable or sacrificial shields.
- Development of active shielding systems, including triggering through radio frequency broadcast.

The book consists of 11 chapters from leading researchers in the world and broadly covers the field of blast mitigation. It includes chapters on dampening of blast overpressure, energy absorption, and reflection from structures during blast loading, fluid–structure interaction, structural collapse during post-blast and design of novel and better structural configurations. The topic of implosion during blast loading is also discussed. In addition, the structural and material response to air blast as well as underwater blast is addressed.

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