

3D PRINTED AND BLAST RESISTANT SMALL SCALE EXPERIMENTAL STRUCTURE

Pierre Legrand¹, Raphael Gavart¹, Sophie Trélat¹

*¹Institut de radioprotection et de sûreté nucléaire, 12, rue de la Redoute 92260
Fontenay-aux-Roses, France ;*

Key words: 3D printing, experiments, blast wave, numerical simulation

Abstract:

In recent years, 3D printing has become a popular technique for designing and manufacturing custom parts and components in a variety of scientific fields as well as for individual consumers. In this paper, we explore the use of 3D printing for the fabrication of small-scale structural components used in blast experiments. The aim of this research is to demonstrate the ease of manufacturing small-scale structures from scratch, using only laboratory resources, that can withstand blast waves without significant deformation.

First, numerical simulations were used to select the optimal material and to assess and refine the printing parameters. Next, an experimental campaign was conducted to compare pressure data from the new 3D printed prototype with a well-established and reliable structure (made in wood and metal) that have been used in many previous experiments. The pressure-time curves showed no significant differences between the 3D printed prototype and the wooden structure, despite some disconnections between parts of the 3D printed structure.

Finally, this work is put into perspective with the many challenges that need to be addressed to get a better understanding of the 3D printed process to adapted them to the best for manufacturing structural components to be used in blast experiments. Mechanical properties of the final pieces for fast transient loading and the capacity of the small-scale structure to withstand several explosions have to be studied.