EXPERIMENTAL SETUP FOR THE REPRODUCIBLE GENERATION OF PRESSURE WAVES IN FREE FIELD CONDITIONS

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Abstract: The injuries caused by the primary blast are still insufficiently investigated, especially in the torso area [1]. In order to generate sufficiently large data sets, often shock tubes are used [2]. However, these have some limitations, such as blockage, usage of the exit jet, widening cross sections and scaling problems concerning the pressure strength and test objects (like the usage of small mammals) [3]. Therefore, it is appropriate to conduct experiments under free-field conditions, but tests with real explosives are often associated with long preparation and set-up times as well as high safety requirements.
Therefore, this paper introduces an experimental set-up for the reproducible generation of pressure waves under free-field conditions. This experimental set-up aims to create a test environment for a sufficiently large simplified torso model to investigate the behavior of the shock wave within the simplified torso model, especially at the medium interfaces. For the generation, an autoclave is used as a so-called shock wave generator. It has a volume of 0.065m^3 and is filled with a stoichiometric acetylene-oxygen gas mixture. The set-up and turn-around time are about 30 minutes. The following factors have been selected as target variables for the optimization of the shock wave generator: reproducibility of the pressure wave, injury-relevant pulse duration and peak pressure, a pressure curve characteristic corresponding to a military explosive reacting under undisturbed free-field conditions and short set-up times of the experimental setup. For this purpose, the experimental setup will be displayed in this paper. Multiple measurement series are presented, which show the characteristics of the pressure wave. For example, Figure 1 displays a pressure curve of the pressure wave initiated by the gas detonation within the autoclave measured with a pencil probe, representing the current condition. The classic pressure curve can be clearly recognized. In this setup, a maximum overpressure of 0.92 bar in distance of 1 m to the opening is reached and the first positive pressure phase lasts for 1.17 ms. Furthermore, the pressure wave propagates in a hemispherical shape. The characteristics of the shock wave generator are validated by the use of a comparison with a military explosive. Then, a realistic and

relevant load case is set by adjusting the process parameters of the shock wave generator.

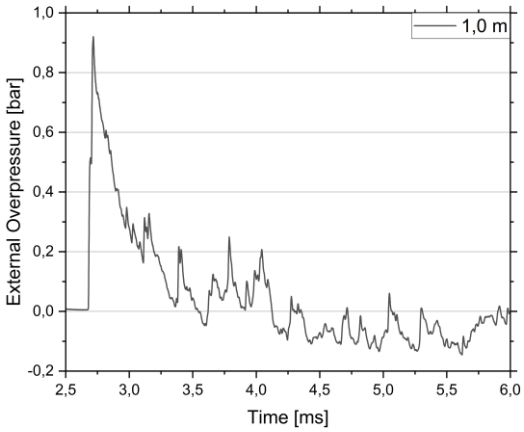

Figure 1: Pressure curve generated by the shock wave generator in a distance of 1.0 m in an angle of 45°.

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