Modelling of blast and detonation shock wave spreading in a dense-constructed area

Nowadays, a lot of industrial accidents accompanied by explosions are happening throughout the world. Also, an increase in the number of terrorist acts committed by means of explosions is observed. For improving the safety of buildings and structures it is necessary to raise their resistance to explosive effects, as well as to be able to predict the degree of potential damage upon explosive loads of various intensities. One of the principal goals in designing the structure resistant to explosive effects is to determine the dynamic response of structures to the impact of the blast wave. Consequently, the transient pressure loads on the walls of the civil engineering structures are to be determined.

The simulation of explosion is highly complicated, mainly due to the shock wave propagation in the air and the following interaction with a structure. In recent years, many efforts have been devoted to the development of reliable methods and algorithms for a more realistic analysis of structures subjected to blast loading. The prediction is most commonly conducted as a simplified analytical and engineering method or using a sophisticated CFD model. The engineering-level techniques permit to estimate an explosive shock impact only for isolated buildings. The complexity of the building, the presence of nearby structures and the surrounding environment can’t be taken into account. To overcome these limitations, various CFD methods are used for the simulation of blast impact on civil engineering objects including in-house and commercial software. Advanced computer aid engineering software techniques combined with the latest methods of discrete three-dimensional city modelling permits to simulate and analyze the effects of explosions in urban areas with a precision which previously was not possible.

Work packages:

- literature search / introduction to the problem
- choosing the test cases for modeling (closed and /or open region; gas or condensed matter explosion)
- getting know with the computer programs for simulations (AUTODYN, Fluent, in-house code, etc);
- performing the computations of the test configurations;
- analysis of results; comparison with experimental data;
- parametric computations for varying explosion strength;
- study of ideal and real gas EoS influence;
- Preparation of the report
Anmerkung:

Die Masterarbeit wird in Novosibirsk, Russische Föderation, an der Staatlichen Universität für Architektur und Bauingenieurwesen, SIBSTRIN, im Rahmen der seit Oktober 2015 bestehenden Kooperation zwischen der Universität Stuttgart und dem „Consortium of Novosibirsk Universities“, CNU, durchgeführt. Dem Konsortium gehören auf russischer Seite neben der genannten Universität auch die Staatliche Universität Novosibirsk, NSU, die Staatliche Technische Universität Novosibirsk, NSTU und die „Siberian State University of Geosystems and Technology an.

Die Finanzierung der Masterarbeit wird über ein Stipendium erfolgen. Russische Sprachkenntnisse sind sicherlich hilfreich, jedoch nicht zwingend erforderlich, die Arbeitssprache ist Englisch.

Für alle weiteren Informationen insbesondere über die Beantragung des Stipendiums wenden Sie sich bitte an Herrn Dr. Uwe Gaisbauer.

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