ADJOINT-BASED DESIGN OF PASSIVE SHOCK MITIGATION DEVICES

R. Lohner[1], F. Camelli[1] & A. Stuck[2]

[1]*George Mason University, Fairfax, VA, USA*
[2]*Hamburg University of Technology, Hamburg, Germany*

The reduction of blast loads on buildings is typically carried out by specifying minimum standoff distances. Achieving acceptable standoff distances may not be possible in city environments. Therefore, the search for architecturally appealing walls, curtains or other aesthetically pleasing blast mitigation devices is a current area of research. Assuming that the amount and the location of the explosive, the location of critical damage areas (windows, facilities) and the design constraints for protective structures are given, one can recast the design of the shock mitigation device as an optimal shape design problem. Of all the possible optimization techniques, those based on the solution of the adjoint equations have the least computational cost.

We have combined unsteady Euler and adjoint Euler solvers in order to obtain, with just one run, the sensitivity (design objective gradients (on all surfaces. Figure 1 shows a typical example. The gradient obtained is shown in Figure 2, the redesign in Figure 3 and the comparison of loads for S1 in Figure 4.