# Model Based Design of Pressure Profiles for Pyrotechnic Actuator Using SPH Method & LsOpt® Solution

Etay Kantor, Yoav Lev (Rafael Ltd., Israel)

February 8, 2015

Pyrotechnic Pistons are communally used as fast reacting actuators in many fields and applications, such as seat belt pretensioners, wire and cable cutters and power disconnect devices. The design of such devices is subjected to many unknowns and the design methodology sometimes consists of many experiments in a trial & error methodology. This paper presents the design process of such a device. In this work a MBD process was applied using LsDyna® model and LsOpt® optimized solution for reaching upper and lower bounds for the pressure profiles of a pyrotechnic device. The numerical solution decreases the number of required experiments in the design process and cuts its costs.
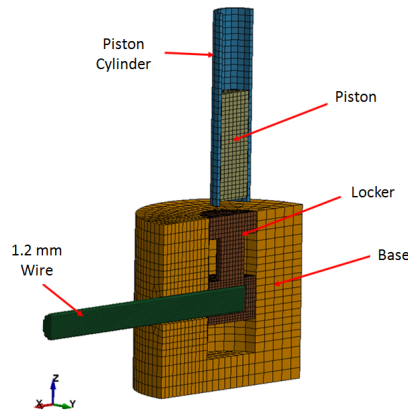


Figure 1: The FE model

The designed device is a micro wire cutter, the piston is subjected to pyrotechnic pressure and cuts a 1.2mm wire. Figure 1 presents the LsDyna® FE

model. The wire is modeled with LsDyna's SPH mesh- less method in order to achieve better representation of the failure and better contact behavior between the wire and the base's sharp edge.

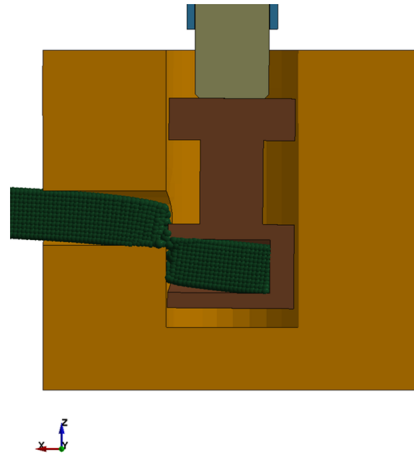The applied pressure is then used to simulate the cutting of the wire as can be seen in Figure 2:



Figure 2: The cutting moment of the wire

The analytic parameters are the design variables used in the LsOpt® tasks, which are solved for two cases- a. In order to find the maximum pressure allowed without deforming the bottom of the stopper base. b. In order to find the minimum pressure that still cuts the wire.

The use of this numeric method greatly decreases the number of required experiments and lets us understand the device's sensitivity to the examined parameters very early in the design stage.