Master thesis proposal: Data-driven prediction of vulnerability due to ricochet impact

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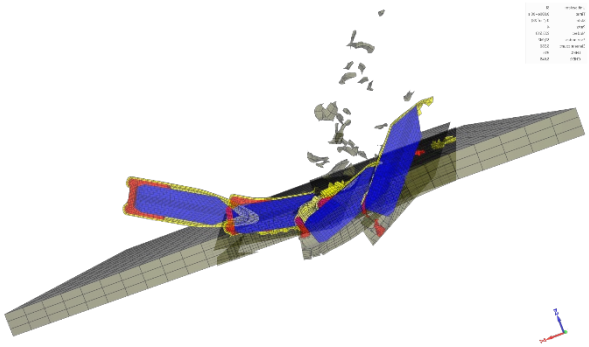

Figure 1: Numerical simulation of a ricochet of an armour-piercing projectile with IMPETUS Afea Solver.

This master project in the research institute ISL will be done in cooperation with IMPETUS-France and INSA Toulouse and combines the two fascinating research domains “neural networks” and “protection against ballistic threats”.

If a projectile impacts an inclined target, it can either ricochet from the surface or perforate the target. The direction of the projectile and debris after interaction with the target is usually evaluated experimentally or simulated numerically if precise numerical models are available. Both methods are extremely time and cost consuming methods to predict the behavior over a large range of different scenarios (impact angle, target thickness, etc.). For tactical planning real time predictions would be necessary, which may be done by AI methods.

Therefore, the first part of this project will be to define a set of impact scenarios that are tested in the lab (experimental). These tests will be conducted in the research facilities of ISL. The second part is to calibrate a numerical model that is sufficiently accurate for these scenarios (numerical). With this numerical model additional numerical simulations shall be conducted to obtain enough data to train an AI model for classification or regression (data science). The main task of this project is then to optimize the neural network architecture for better prediction properties and to show possibilities and limitations of such a model.

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IMPETUS Afea is an expert company in computational mechanics, which develops **IMPETUS Afea Solver**, a non-linear explicit finite element tool. The core business of IMPETUS Afea is in defense and security. For more information visit **www.impetus.no**.

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