Asymptotic analysis to identify spin-stabilized projectiles aerodynamics coefficients from data recorded by a tracking radar.

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Abstract

The main objective of this work is to propose an inverse technique for identifying the aerodynamic coefficients for a wide range of spin-stabilized projectiles from instrumented firing tests without on board instrumentation. As we use experimental data, this identification process must be robust and stable in noisy environment, with incomplete data and has to take the raw meteorologic data into account. The procedure use intermediary ballistic models obtained after an asymptotic analysis of a general ballistic model, the modified point mass method (MPM) where five aerodynamic coefficients are involved. This model is well adapted to a spin-stabilized shell and is always used by the NATO. The principle of this identification method consists in searching for the couple composed of the state parameters and of the aerodynamic coefficients which satisfies the flight equations and leads to a trajectory as close as possible to the recorded data. This leads to solve a non-linear optimization problem under equality constraints. We apply this method initially from numerically generated data and secondly to data recorded by a tracking radar to prove its efficiency.