SEPARATION DYNAMICS STUDY OF A MISSILE LAUNCHED FROM HELICOPTER

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Abstract

A study has been carried out to predict the trajectories of the missile as it is launched from the helicopter using CFD. Helicopter geometry mounted with inboard missile at the exit of the launcher tube is shown in Fig.1. Unstructured tetrahedron grids of the size of 27 million cells were generated around the helicopter configuration including the missile using ICEMCFD. The inboard missile is considered for the separation dynamics analysis. Aerodynamic loads are generated on the missile as each shoe comes out of the launcher tube and are used to generate the tip-off data using constrained 3-degres of freedom (3DOF) code. The tip-off rates obtained from the above constraint simulation are used as initial condition for further integrated separation dynamic studies. The studies have been carried out using dynamic mesh modelling in FLUENT [1] which accounts the motion of cell boundaries while resolving the flux terms across the faces. Local re-meshing is done when the cell quality reaches beyond the threshold limit. In order to account for the influence of the main rotor wake, rotor flow is modelled using an actuator disc approach. In the present study, tail rotor is not modelled as its effects are insignificant to the missile trajectory. Thrust misalignment is considered in the current study. CFD based separation studies of missile has been carried out and trajectories are predicted from the exit of the launcher tube to till the missile clears helicopter main rotor. Missile trajectories are predicted during hovering of the helicopter and at different forward speeds with different combination of angles of attack and sideslip angles. In all the considered flight conditions the missile is separating safely form the helicopter in 0.15 s as shown in Fig 2. Enough clearance between the missile and main rotor tip can be seen at the time of missile is clearing the main rotor disc. Displacements and Euler angles of the missile w.r.t time are plotted in Figs. 3 and 4.

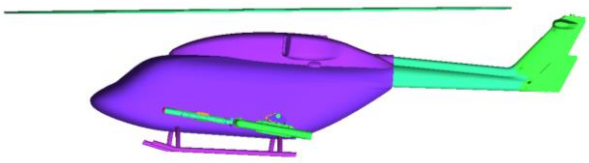

FIGURE 1: HELICOPTER MOUNTED WITH MISSILES (SIDE VIEW).

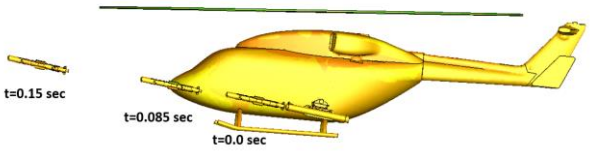

FIGURE 2: TRAJECTORY OF THE MISSILE AT THE HOVERING OF THE HELICOPTER.

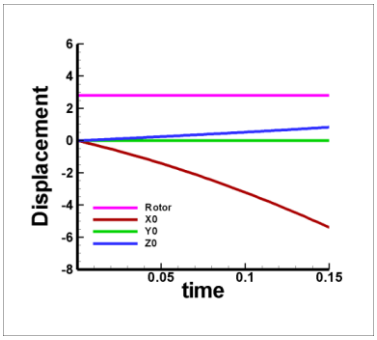

FIGURE 3: DISPLACEMENT OF MISSILES W.R.T TIME AT HOUR.

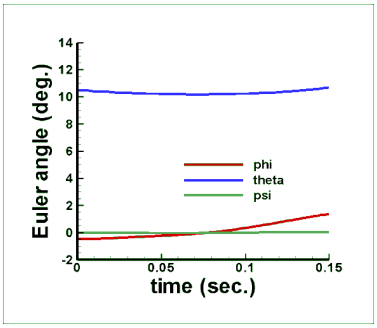

FIGURE 4: EULER ANGLES OF MISSILE W.R.T TIME AT HOUR.

References:

1. ANSYS Fluent user guide.

2. Konark Arora, K. Anandhanarayanan, R. Krishnamurthy and Debasis Chakraborty., "17th Annual AeSI CFD Symposium, 11th -12th August 2015, Bangalore, India.