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Planning of Hypersonic Boost-Glide Vehicle Penetration Trajectory

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Introduction

The existing no-fly zone planning methods for hypersonic boost-glide vehicles have problems such as low computational efficiency and insufficient stability. In order to deal with these problems, a trajectory planning method combining deep neural network and pseudospectral method is proposed to realize flying around while satisfying the constraints of variables.

Research Questions

The main research problem of this paper is how to realize safe and stable online path planning of hypersonic boost-glide vehicle.

Methodologies

Pseudospectral method, Deep neural network

Mathematical Formulas

$$x(\tau_i) = X(\tau_i), (i = 0, \cdots, K) \tag{1}$$

$$u(\tau_i) = U(\tau_i), (i = 1, \cdots, K) \tag{2}$$

$$C_1' \le U_k \le C_2' \quad (k = 1, \cdots, K) \tag{3}$$

$$C_3' \le \dot{U}(\tau_k) = \sum_{i=1}^{K} \dot{L}_i(\tau_k) U(\tau_i) = \sum_{i=1}^{K} D_{ki}(\tau_k) U(\tau_i) \le C_4' \tag{4}$$

$$\kappa^{(k)}(\tau) = \frac{\left|\ddot{x}_m^k(\tau)\right|}{\left[1 + \left(\dot{x}_m^k(\tau)\right)^2\right]^{3/2}} \tag{5}$$

Figure

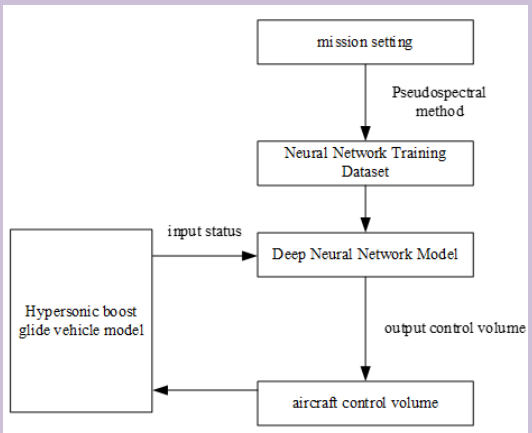

FIGURE1 Trajectory planning flowchart

Conclusion

This research provides a real-time trajectory optimization strategy based on deep neural network to address the real-time obstacle avoidance trajectory planning problem of hypersonic vehicle.