TRAJECTORY OPTIMIZATION FOR A HEAVY LAUNCHER: A HAMILTON–JACOBI APPROACH

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Abstract. In this talk, we will present a global optimization approach for the flight of a three-stage launcher. The aim of this trajectory optimization problem is to minimize the consumption of ergols that is needed to steer the launcher from the Earth to the GEO. Here the global optimization procedure is based on Hamilton-Jacobi-Bellman approach. The optimization problem takes into account a complete flight model and includes the transfer from the GTO to the GEO orbit. It leads to a control problem in 6-dimensional state-space and involves some additional optimization parameters.

We first set the problem in the framework of optimal control problems and show how to deal with the parameters without increasing the dimension of state space. Then we present the global optimization procedure based on solving some Hamilton-Jacobi equations. We study the convergence result of the optimization procedure and show the relevance of the approach for approaching the optimal trajectory.

As the control problem is set in a high dimensional state-space, we analyse the computation effort to be made for solving the corresponding Hamilton-Jacobi equations and compare the optimal result with a reference trajectory provided by CNES.

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Keywords: Trajectory optimisation, Hamilton-Jacobi approach, ENO scheme, feedback reconstruction

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