Ignatovich, S. Yu.; **Sukhinina, Yu. V.**

Time-optimal control problem with two final points for a kinematic model of an UAV.
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Summary: We study the time-optimal control problem for an unmanned aerial vehicle (drone) moving in the plane of a constant altitude. A kinematic model is considered where the angular velocity is a control. Such a system is described by Markov-Dubins equations. A large number of works are devoted to solving different optimal and admissible control and stabilization problems for such models. In the papers *T. Maillot* et al., J. Dyn. Control Syst. 21, No. 1, 47–80 (2015; Zbl 1328.93205) and *M.-A. Lagache* et al., Math. Control Relat. Fields 7, No. 2, 259–288 (2017; Zbl 1360.93552) the time optimal control problem is solved where the drone must reach a given unit circle in the minimal possible time and stay on this circle rotating counterclockwise. In particular, in the mentioned works it is shown that is this case the problem is simplified; namely, the problem becomes two-dimensional. In the present paper we consider a natural generalization of the formulation mentioned above: in our problem, the drone must reach a given unit circle in the minimal possible time and stay on this circle, however, both rotating directions are admissible. Such a reformulation leads to the time-optimal control problem with two final points. In the paper, we obtain a complete solution of this time-optimal control problem. In particular, we show that the optimal control takes the values ± 1 or 0 and has no more than two switching. If the optimal control is singular, i.e., contains a piece $u = 0$, then this piece is unique and the duration of the last piece equals $\pi/3$; moreover, in this case the optimal control ins non-unique and the final point can be $(0, 1)$ as well as $(0, -1)$. If the optimal control is non-singular, i.e., takes the values ± 1, then it is unique (except the case when the duration of the last piece equals $\pi/3$) and the optimal trajectory entirely lies in the upper or lower semi-plane. Also, we give a solution of the optimal synthesis problem.

MSC:

49N35 Optimal feedback synthesis
93C10 Nonlinear systems in control theory

Keywords:

a kinematic model; time-optimal control problem; optimal synthesis

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