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TRAJECTORY CONTROL OF 3D OBSERVATIONS FROM AN UAV BY ANGULAR MEASUREMENTS

D. D. Emeliyanov, E. Ya. Rubinovich

We consider the 3D problem of controlling the trajectory of an unmanned aerial vehicle (UAV). The purpose of the control is to increase the accuracy of estimating the spatial coordinates of the UAV from discrete angular measurements of the position of a fixed beacon in the process of guidance of the UAV to a given terminal set. The measurements are contaminated by a discrete white noise with known characteristics. The total guidance time is specified.

Keywords: UAV, angular measurements, control of observations, terminal guidance.

REFERENCES

1. Nardone S.C., Aidala V.J. Optimization of observer trajectories for bearings-only target localization. *IEEE Trans. Aerospace and Electronic Syst.*, 1981, vol. AES-17, no. 2, pp. 162–166. doi: 10.1109/TAES.1981.309141 .
2. Liu P.T. An optimum approach in target tracking with bearing measurements. *J. Optim. Theory Appl.*, 1988, vol. 56, no. 2, pp. 205–214. doi: 10.1007/BF00939407 .
3. Oshman Y., Davidson V. Optimization of observer trajectories for bearings-only target localization. *IEEE Trans. Aerospace and Electronic Syst.*, 1999, vol. 35, no. 3, pp. 892–902. doi: 10.1109/7.784059 .
4. Miller A., Miller B. Tracking the UAV trajectory on the basis of bearing-only obervations. In: *Proc. 53rd IEEE Conf. Decision and Control — CDC2014*, N Y: IEEE, 2014. pp. 4178–4184. doi: 10.1109/CDC.2014.7040040 .
5. Zajic T., Mahler R.P.S. Particle-systems implementation of the PHD multitarget tracking filter. In: Proc. SPIE Conf. Series, 2003, vol. 5096, pp. 291–299.
6. Lanneuville D., Houssineau J. Passive multi-target tracking with GM-PHD filter. In: *Proc. 13th Conf. Inform. Fusion*, N Y: IEEE, 2010, pp. 1–7. doi: 10.1109/ICIF.2010.5711954 .
7. Bar-Shalom Y., Willett P.K., Tian X. *Tracking and data fusion: A handbook of algorithms*. Storrs, CT: YBS-Press, 2011, 1235 p. ISBN: 0964831279 .
8. Lin X., Kirubarajan T., Bar-Shalom Y., et al. Comparison of EKF pseudomeasurement and particle filters for a bearing-only target tracking problem. In: *Proc. SPIE Conf. Series Signal and Data Processing of Small Targets* / ed. Oliver E. Drummond, 2002, vol. 4728, pp. 240–250. doi: 10.1117/12.478508 .
9. Andreev K.V., Rubinovich E.Ya. Moving Observer trajectory control by angular measurements in tracking problem. *Autom. Remote Control*, 2016, vol. 77, no. 1, pp. 106–129. doi: 10.1134/S0005117916010069 .
10. Miller S.A., Harris Z.A., Chong E.K.P. A POMDP framework for coordinated guidance of autonomous UAVs for multitarget tracking. *EURASIP J. Adv. Signal Process.*, 2009, Article ID: 724597, 17 p. doi: 10.1155/2009/724597 .
11. Emel'yanov D.D. To the problem of trajectory control of observations. *Autom. Remote Control*, 1997, vol. 58, no. 10, pp. 1592–1600.
12. Liptser R.S., Shiryaev A.N. Statistics of random processes. Berlin: Springer, 1978. 457 p. doi: 10.1007/978-3-662-13043-8 .

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Dmitry Dmitrievich Emeliyanov, Cand. Sci. (Engineering), Particle Physics Department of STFC Rutherford Appleton Laboratory, Harwell Science and Innovation Campus, OX11 0QX UK, e-mail: d.emeliyanov@outlook.com .

Evgeny Yakovlevich Rubinovich, Dr. Sci. Engineering, Prof., Trapeznikov Institute of Control Sciences of the Russian Academy of Sciences, Moscow, 117997 Russia, e-mail: rubinvch@ipu.rssi.ru .

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