Underwater Investigations and Robotics. 2019. No. 3 (29). P. 4–14.

THE SMALL-SIZED REMOTELY OPERATED VEHICLE WITH STABILITY CONTROL

**Bykanova A.Yu., Kostenko V.V., Storozhenko V.A., Tolstonogov A.Yu.**

Institute for Marine Technology Problems FEB RAS

5a, Sukhanov Str., Vladivostok, 690950. Ph.: (423) 243-24-16.690059. E-mail: vkost@marine.febras.ru

**ABSTRACT**

The results of design and development of the small-sized remotely operated vehicle with autonomous power supply and optic fiber tether are presented. The vehicle is capable to control position with arbitrary angles of orientation. The control of roll angle of the vehicle is being not only by the propulsion system of the vehicle but also by control of stability of one.The stability control is implemented by changing the position of center of buoyancy and gravity of the vehicle in the transverse plane. The quaternion-based kinematics was used to implement orientation control for achieving full-range regulation. The main technical solutions were proved during the test in pool of remotely operated vehicle “Millennium Falcon” for All-Russian underwater competition “AquaRoboTech-2018”.

**Key words:** remotely operated vehicle, stability control, orientation control, quaternions, swimming pool tests.

**REFERENCES**

1. Ferreira B.M., Jouffroy J. Control and guidance of a hovering AUV pitching up or down // Proc. of OCEANS 2012 MTS/IEEE. Hampton

Roads, USA, 2012. P. 1–7.

2. Lyamina E.A., Egorov S.A. Osobennosti postroeniya sistemy upravleniya uglovoy orientatsiey podvodnogo apparata dlya bol'shikh uglov naklona // Inzhenernyy zhurn.: nauka i innovatsii. 2018. Vol. 3. P. 1–19.

3. Lyamina E.A. Podkhody k postroeniyu sistemy upravleniya uglovym polozheniem neobitaemogo podvodnogo apparata bez ogranicheniy na ugly naklona // Tr. Krylovskogo gos. nauch. tsentra. Spets. Vol. 1. 2018. P. 224–234.

4. Pat. 2421372 RF, MPK B63G 8/00. Sposob obespecheniya upravlyaemosti podvodnym apparatom / Komarov V.S., Komarov P.V.; zayavitel' i patentoobladatel' Komarov V.S., Komarov P.V. No. 2007141792/11; zayavl. 14.11.2007; opubl. 20.06.2011, Byul. No. 17.

5. Pat. 15462531 SShA. Autonomous ROVs With Offshore Power Source That Can Return To Recharge / Chance T. et al.; 2017.

6. Kostenko V.V., Mikhaylov D.N. Development of the remotely operated underwater vehicle “MAKS-300” // Underwater investigation and robotics. 2012. No. 1 (13). P. 36–46.

7. Pavin A., Inzartsev A., Eliseenko G. Reconfigurable distributed software platform for a group of UUVs (yet another robot platform // Proc. of OCEANS 2016 MTS/IEEE. Monterey, Monterey, CA, 2016. P. 1–7. doi: 10.1109/OCEANS.2016.7761102.

8. Bradley A.M. et al. Power systems for autonomous underwater vehicles // IEEE Journ. of Oceanic Engineering. 2001. Vol. 26. No. 4.

P. 526–538.

9. Bykanova A.Y., Storozhenko V.A., Tolstonogov A.Y. The Compact Remotely Operated Underwater Vehicle with the Variable Restoring

Moment // IOP Conference Series: Earth and Environmental Science. IOP Publishing. 2019. Vol. 272. No. 2. P. 022199.

10. Stuelpnagel J. On the parametrization of the three-dimensional rotation group // SIAM review. 1964. Vol. 6. No. 4. P. 422–430.

11. Fjellstad O. E., Fossen T. I. Position and attitude tracking of AUV’s: a quaternion feedback approach // IEEE J. of Oceanic Engineering. 1994. Vol. 19. No. 4. P. 512–518.

12. Johansen T.A., Fossen T.I. Control allocation – a survey // Automatica. 2013. Vol. 49. No. 5. P. 1087–1103.