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Development of a gravity gradiometer system for submarine gravity prospecting

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Gravity prospecting is the method to detect underground density structure, and it is one of the most useful prospecting techniques on the seafloor where drilling is difficult to perform. We are working on development of a underwater hybrid gravimetry system including a gravimeter and a gravity gradiometer. In this paper, a gravity gradiometer system for submarine gravity prospecting is described.

As compared to a gravimeter, a gravity gradiometer is sensitive to localized density structure, and hence it is well suited to survey on concentrated source such as ore deposits. The gravity gradiometer comprises two vertically-separated gravity sensors, and the gravity gradient can be obtained from the differential signal between them. Because any common noise to the gravity sensors, such as translation acceleration and thermal drift, is canceled by taking the differential signal, the gravity gradiometer is preferable as an onboard instrument in the underwater vehicle. In this case, rotation of the instrument would be a major noise source and is controlled to keep it vertical as in the case of the gravimeter.

Along with design and performance of the gravity gradiometer being developed for the submarine gravity prospecting, the verticality control system to be installed in an AUV will be presented.

Keywords: gravity gradiometer, gravity prospecting, gravimeter, underwater, AUV, hybrid gravimetry