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**Underwater vehicle attitude estimation using Hough transformation**

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In these decades various imaging sonar systems have been developed. They are very effective for underwater investigations such as geologies, fisheries, resource surveys and securities. To extend these system abilities we studied new imaging sonar applications and found they are also useful in underwater vehicle navigations. In this presentation I propose a new method of estimating vehicle attitude parameters relative to the ocean surface or the seafloor by the onboard imaging sonar. The ocean surface or the seafloor is often obtained as a plane in sonar images. However, the images are sometimes too noisy to identify the plane locations because of ambient noise and reverberations by texture patterns on the planes. The new method describes these planes with plane equation parameters connected to attitude parameters, and searches the most appropriate parameter sets using a voting procedure which is a three dimensional expansion of the Hough transformation widely applied in line detections on noisy two dimensional images. The method provides the plane location and attitude parameters simultaneously without other sensors. After the algorithm explanation multi-beam imaging sonar simulations are shown and accuracies are evaluated.