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Artificial Characteristic Landmarks for SLAM navigation

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The use of Autonomous Underwater Vehicles (AUVs) for a variety of purposes is set to increase in the future. A key issue in the navigation processing, especially for survey applications, is the lack of accuracy or cumulative error introduced by the various position sensors: accelerometer; DVL; compass. Algorithms such as SLAM (simultaneous localisation and mapping) rely on accurate landmark recognition in order to correct the vehicle position. This paper proposes a solution based on broadband sonar and artificial coded landmarks to improve the navigation. Through resolution of the wave equation for acoustic propagation in a multilayer concentric sphere, we will show that there is a great diversity in the echo spectrum with small changes in internal structure. This enables the design of a set of passive landmarks which can be identified unambiguously, since each has a characteristic signature or 'spectral code' when insonified with a broadband sonar.