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Detection of geometric deformations on maritime technical structures through Unmanned Aerial Systems

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Geometric representation, documentation and inspection of the energy related infrastructure on the oceans, is essential for the prevention of accidents or failures that may lead to enormous environmental disasters. Unmanned Aerial Vehicles for image acquisition have been widely used for geomorphological mapping of the Earth's surface and for the representation of geometrical characteristics in various technical constructions. Nevertheless, the sea itself introduces a challenging environment since the related entities, including oil platforms, transport ships, port constructions, reside on a constantly moving and unstable sea. Thus, classic topographic surveying fails to establish accurate control points, since the entities move under a stable coordinate system.
As part of the energy related infrastructure, geometric evaluation of already assembled ships is an important function of shipbuilding, as it allows the monitoring of changes in the form of ships including normal wear and tear, possible additions, collision implications and therefore provides the prospect of intervention for rehabilitation, protection and maintenance. Thus, the subject of the present study is to provide a semi-automatic inspection methodology with the aid of an Unmanned Aerial Vehicle for checking the geometrical consistency of structural elements for liquid / gas transport vessels.
Under this course of the study, novel methods of coordinate establishment for photogrammetric control point acquisition are investigated, adapted and applied in the particular conditions on the curved hull surfaces of ships and under varying ship mounting conditions. The three-dimensional surface models are created while vertical cross-sections are formed and compared with the theoretical construction hull curves in order to: a) verify the overall geometry of the adjusted surfaces, b) identify any defects on the surface of the ship, and c) provide coordinates and analytics for the specific deformations. The results show strong comparative advantages of the proposed methodology in terms of cost, time, accuracy, supervision, in relation to current control practices for the detection of deformations that potentially influence structural and morphological characteristics.