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Abstract: Advances in microelectronics and computing brought about revolutionary changes in perception of autonomous aerospace systems, enabling unprecedented access to high resolution information for proximity operations. The talk focuses on the use of a data fusion approach to relative navigation of aerospace vehicles and on methods of photometric stereopsis. A computational vision pipeline is discussed that utilizes vision features to provide a relative navigation solution useful for space proximity operations. Photometric stereo approach of shape reconstruction is contrasted with traditional methods of photogrammetry. Methods to accommodate relative motion are discussed, along with associated uncertainty quantification techniques. A systematic approach to derive covariance associated with the celebrated Kanade-Lucas-Tomasi (KLT) feature tracking algorithm is presented and the results are utilized to derive error estimates associated with the normal map of the reconstructed surface. Preliminary design of a novel photometric stereo sensor is presented, along with representative tests carried out using emulated imagery obtained by using a ray-tracing engine developed by the presenter's research group. Talk concludes with glimpses of the presenter's recent work on magnetometry and sensor fusion activities for geospatial information fusion.