Automated Rendezvous and Docking with Video Imagery

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For rendezvous and docking, assessing and tracking relative orientation is necessary within a minimum approach distance. Special target light patterns have previously been considered for use with video sensors for ease of determining relative orientation. This work is a generalization of those approaches. At certain ranges, the entire structure of the target vehicle constitutes an acceptable target; at closer ranges, substructures will suffice. Acting on the same principle as the human intelligence, these structures can be compared with a memory model to assess the relative orientation and range. Models for comparison are constructed from a CAD facet model and current imagery. This approach requires fast image handling, projection, and comparison techniques which rely on rapidly developing parallel processing technology.

Relative orientation and range assessment consists of successful comparison of the perceived target aspect with a known aspect. Generating a known projection from a model within required times, say subsecond times, is only now approaching feasibility. With this capability, rates of comparison used by the human brain can be approached and arbitrary known structures can be compared in reasonable times.

Future space programs will have access to powerful computation devices which far exceed even this capability. For example, the possibility will exist to assess unknown structures and then control rendezvous and docking, all at very fast rates. We now take the first step which has the current utility, namely applying this to known structures.