Virtual Environment (VE) Interface for Remote Inspection

A virtual environment interface to monitor and control a simulated free flying inspection vehicle designed to detect damage to an Orbiter's thermal protection system is being developed. Its usefulness as an interface for control and monitoring of remotely operated semiautonomous inspection vehicles such as, AERCam, will be investigated.

Background

Since the earliest conception of virtual environment displays by Ivan Sutherland in the mid-'60's, the obvious naturalness of this display format suggested it could be the "ultimate" visual display, a display that could give the user the illusion of being at the remote or synthetized site. However, initial excitement regarding its application to a wide variety of tasks underplayed a great difficulty posed to designers.

Since the display essentially puts the user into a completely synthetic environment, the system developer is faced with the issue of simulating a good many elements of what makes up a real world. This is a formidable technical task. The geometry, kinematics, dynamics, and control processes in real worlds are detailed, complex, and often unpredictable making completely accurate simulation difficult in real time. Recent technical advances, however, have rekindled interest in designing virtual environment interfaces for a variety of tasks involving teleoperation.

Research Overview

An existing high dynamic fidelity virtual environment system is being adapted to simulate a control interface for an free flying inspection satellite. This simulated device will be able to inspect surfaces on a co-orbiting vehicle such as the Shuttle Orbiter. One experiment will investigate the required dynamic fidelity for such a VE based interface. It will also study the interaction of the system's dynamic responsiveness and the field of view of the head mounted display used to present the VE. This VE interface will be compared later with a panel-mounted interface similar to conventional UAV control stations.

A second experiment will examine the use of predictive filters incorporating head movement dynamics to compensate adaptively for latency due to varying rendering load in such interfaces. In essence we will be examining the basis of why virtual environment interfaces have heretofore been found inferior to more traditional panel mounted alternatives. We will explore new methods to reverse this finding.

Virtual Environment (VE) Interface for Remote Operations Inspection: AERCam

Relevance to Exploration Systems

Remote operation capacity will greatly increase the ability of researchers to control and monitor exploratory vehicles. Hence, it is likely that improvements in the user interfaces to operate these vehicles will have a major impact on scientific productivity.

H&RT Program Elements:

This research capability supports the following H&RT program /elements:

ASTP: Advanced Studies, Concepts, & Tools; Software, Intelligent Systems & Modeling

TMP: Advanced Space Operations

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