

EXOSTATION

Haptic Exoskeleton Based Control Station

Project Overview

The Prime Objective of the project was to develop a haptic control station, called "EXOSTATION", allowing the operator wearing an exoskeleton-based haptic interface to teleoperate a virtual slave robot.

EXOSTATION is a complex system, made of the following components (see figure):

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SAM (Sensoric Arm Master), which consists of a 7-DOF force-feedback human arm exoskeleton;

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ECO, the EXOSKELETON controller;

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the Slave Simulator which simulates an anthropomorphic robot slave and the robot's environment;

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The 3D Visualization Client, which is the graphical user interface.

EXOSTATION overview

The system will find a wide range of applications, from training in virtual reality to teleoperation of real robot in the field of remote maintenance, CBRNe hazardous environment but also space exploration. Indeed, in future space missions, robots will be used as first explorers in hostile environment or as assistants for Extra-Vehicular Activities (EVA). This will require a higher level of cooperation between astronauts and robots. For this, the use of a portable device procuring the robot operator with force-feedback sensations will highly increase the precision and intuitiveness in the control of the command task.

Because of the challenging objectives of the project, requiring academic research in haptics, the project has been split in two phases:

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Phase A performing design trade-offs and developing a fully integrated 1-DOF Haptic Testbed Demonstrator;

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Phase B implementing the complete EXOSTATION system with a 7-DOF haptic chain running at a 500 Hz frequency.

CAD Model of SAM

SAM prototype

STUDY TEAM

Space Applications Services is the Prime Contractor and was responsible for the system specification and integration and in particular for the simulation component, including the slave simulator and the visualisation client. The project was conducted by the System & Ground Segment (S&GS) engineering group.

ASL - ULB (Prof. A. Preumont) and Micromega Dynamics (J.P. Verschueren) are sub-contractors. ULB is responsible for the mechanical design and construction of the exoskeleton. Micromega Dynamics is responsible for the electronics.

PROJECT DETAILS

Project funding: ESA/ESTEC GSTP program (contract number: 18408/04/NL/CP)

Period: 2005-2006 (Phase A), 2007-2009 (Phase B).

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