Opposed-type Multi-Fingered Haptic Interface Robot

HandHIRO

The Mark Resistration Number 5419404

Model : HIRO III

HIRO III SPECIFICATIONS

Degree-of-freedom (DOF)	Hand	15 joints, 15 DOF (Five haptic fingers)
	Arm	6 joints, 6 DOF
Weight		About 3.8 kg (HIRO III, Body)
Presentation Force		Three axis forces (x,y,z axis) at human five fingertips
Fingertip Force		3.6 N Minimum
Fingertip Force Resolution		0.05 N
Control Apparatus	OS	ART-Linux
	Sampling Time	1 ms
	Weight	About 23 kg
Power Consumption		1500 W

Opposed-type Five-Fingered Haptic Interface Robot, **HandHIRO** (Hand Haptic Interface RObot), is a general-purpose haptic interface robot newly developed to realize a distinguished virtual reality work environment, which enables to give multipoint haptic senses.

■ FEATURES

HIRO III is composed of an arm and a hand with five haptic fingers. An operator wears five finger-holders and links them up with these five haptic fingers, which provide force senses to the operator's five fingertips.

The arm has six degrees-of-freedom (DOF) and the hand has fifteen, so a total of 21 DOF make **HIRO III** a hyper multiple DOF system. This enables to provide a wide operating space. Usually this kind of multiple DOF system requires highly complicated control system for its operation. However, **HIRO III** is accommodated with a sufficient number of elemental commands to bring it into action, so that you can develop any effective operating program to use it as a research tool soon after the purchase.

Due to a simple structure of the finger holder that restrains only the operator's fingertips, there is no oppressing feeling against the operator's hand, and the floor type interface can provide the weight perception of the virtual working material.

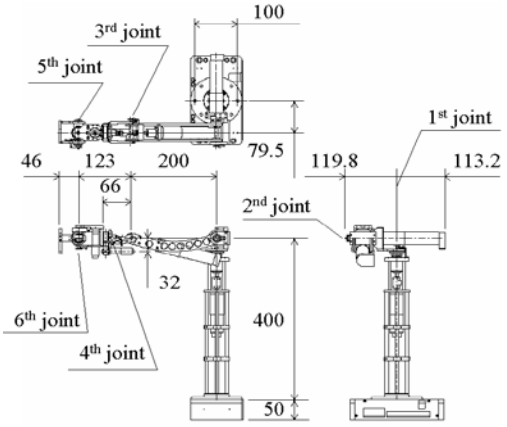
HIRO III is the world's first Opposed-type Multi-Fingered Haptic Interface providing real force feelings including weight perception to operator's five fingertips.

The photograph is an example to show a virtual space work of cutting a sheet-like substance with **HIRO III** and a scissor-like device.

■ ARM

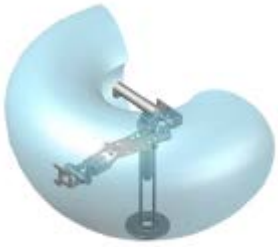
The arm of **HIRO III** is composed of an upper arm and a front arm, and has three DOF in the shoulder part, one in the elbow and two in the wrist, in total six DOF. It is so designed that the operator can handle it on the table. Movement of this arm allows the location and the attitude of the robot hand to follow that of operator's hand.

ARM MECHANISM Figure



ARM SPECIFICATIONS

	Range of Movement (deg)
The first joint	±110
The second joint	−125～0
The third joint	0～+145
The fourth joint	±90
The fifth joint	±90
The sixth joint	±60

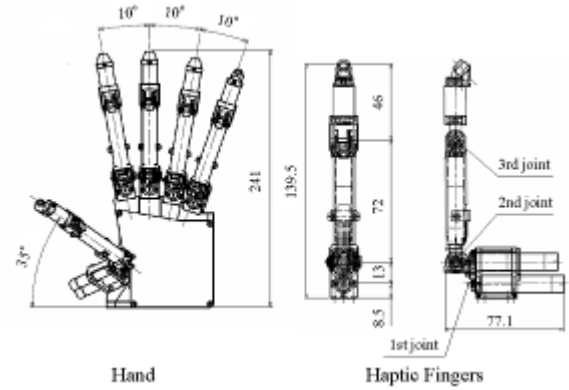


The mobile range of the arm

■ HAND

The hand of **HIRO III** has five haptic fingers; each of them has three joints and three DOF. A three-axis force sensor is mounted on the tip of each haptic finger to detect the force given to the tip. The hand control apparatus is composed of an interface circuit including FPGA, 15 channels motor driver circuit and amplifier circuit of the three-axis force sensor. It is incorporated in the palm part of the hand and realizes the communication between the operator and a personal computer through LAN.

HAND MECHANISM



Hand　　Haptic Fingers

Fingertip Force: 3.6 N Minimum
Fingertip Force Resolution: 0.05 N

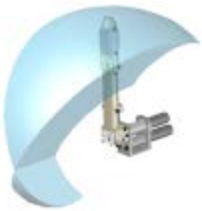
HAND SPECIFICATIONS

・**Thumb**：

	Range of Movement (deg)
The first joint	±36
The second joint	−35～+90
The third joint	0～+112

・**Other fingers**：

	Range of Movement (deg)
The first joint	±30
The second joint	−30～+90
The third joint	0～+112



The mobile range of the fingers

■ CONTROL APPARATUS AND CONTROL LIBRARY

The control apparatus of **HIRO III** is a small box of 443 × 222 × 464 mm size. **HIRO III** is a hyper multiple DOF system with total 21 DOF. Usually the control of this kind of system is complicated; however, the elemental commands contained in the control program library can help you in effective program development.

■ AWARD

The Japan Society of Mechanical Engineers, Tokai-Branch Distinguished Project Award for 2008

※Available for sale since October 2008.　　All numerical values in this document are for reference.

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