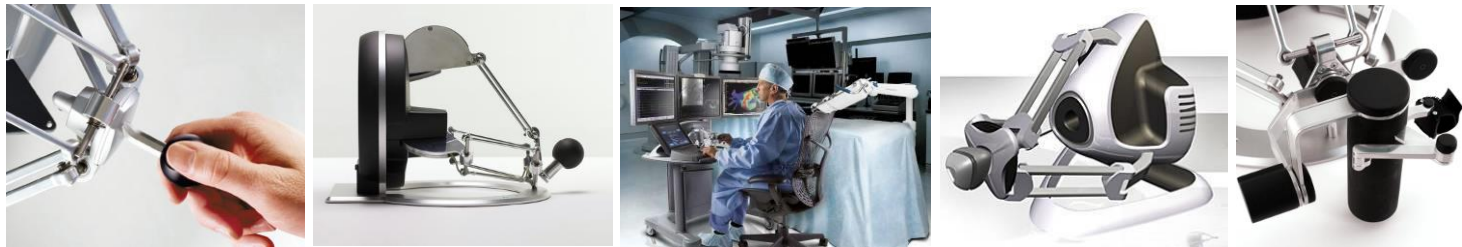


Designing Commercial Haptic Devices



ME 327

05/09/2014

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Commercial Haptic Devices

A 10 Year Journey



Haptics

The Sense of Touch



Haptic Devices

Market and Applications

Cybergrasp
Virtual Technologies



Phantom
MIT / Sensable Technologies



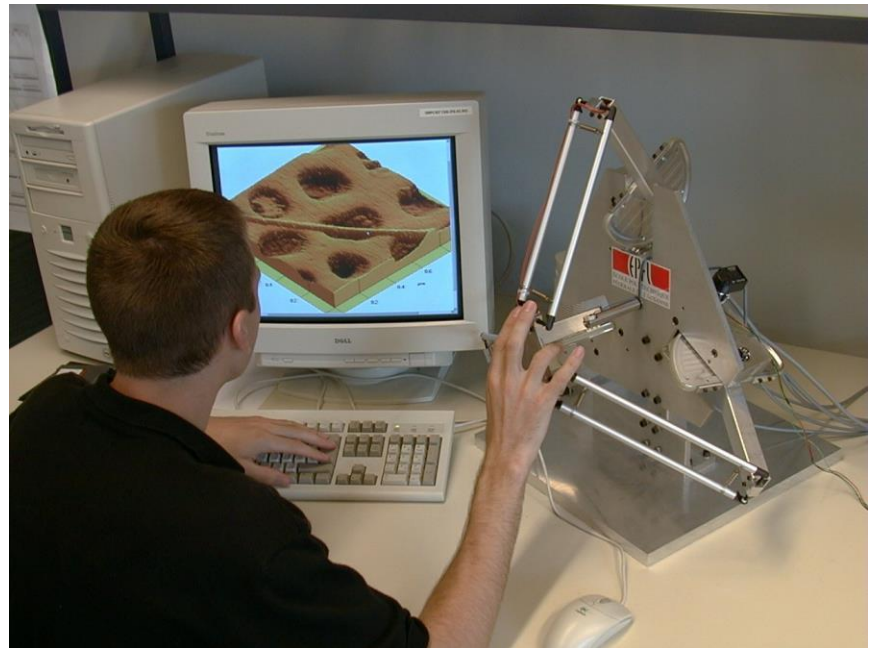
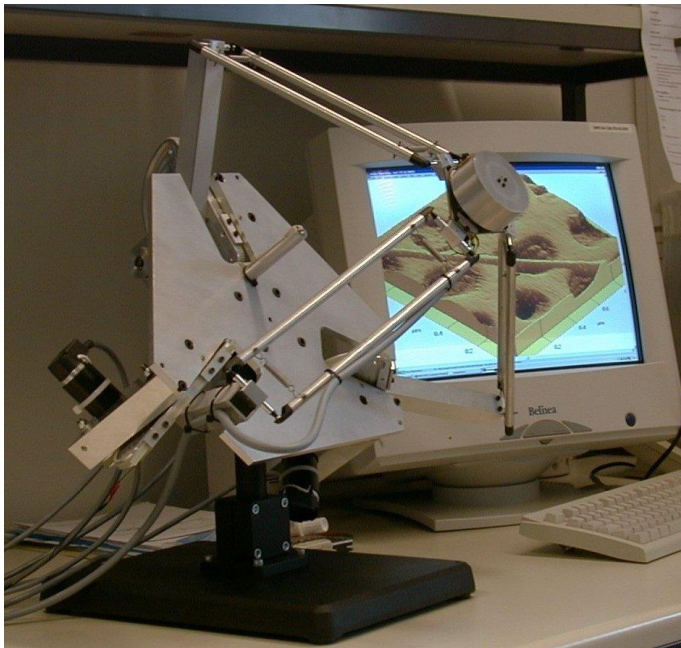
iDrive
Immersion Corporation



Haptic Workstation
Immersion

Le Syntaxeur

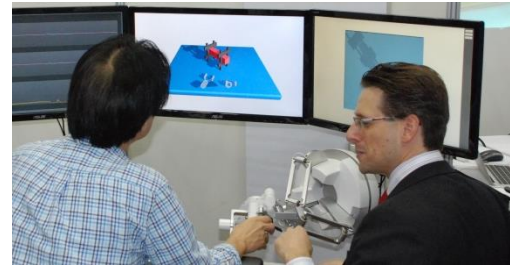
EPFL – Ecole Polytechnique Fédérale de Lausanne



Le Syntaxeur
EPFL, Switzerland

Creating a Company

Designing and Manufacturing Haptic Devices



Force Dimension
Switzerland

Developing a Product

Industrial Design



omega.3
Force Dimension

3D Consumer Haptic Interfaces

Design Challenges



omega.3
\$20'000



Falcon
\$200

3D Consumer Haptic Interfaces

Design Challenges



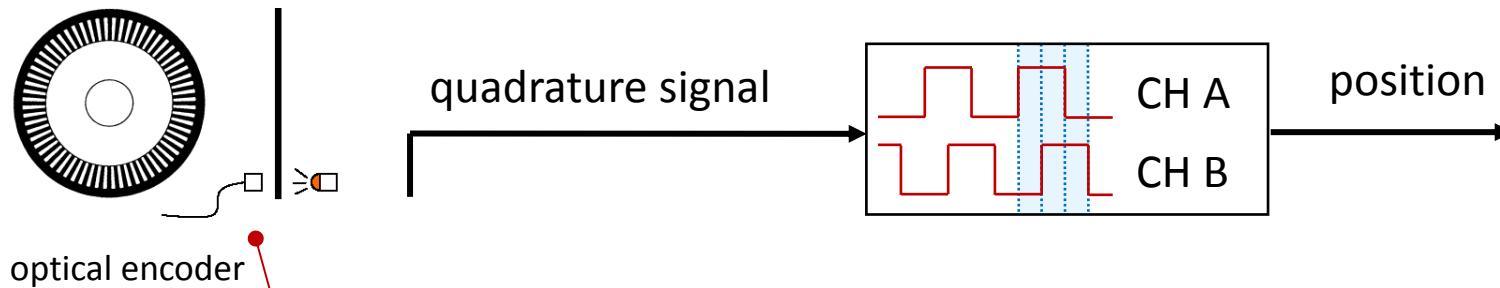
Maxon Motor
\$150



Johnson Motor
\$1.50

Position Sensors

Optical Encoders



optical encoder

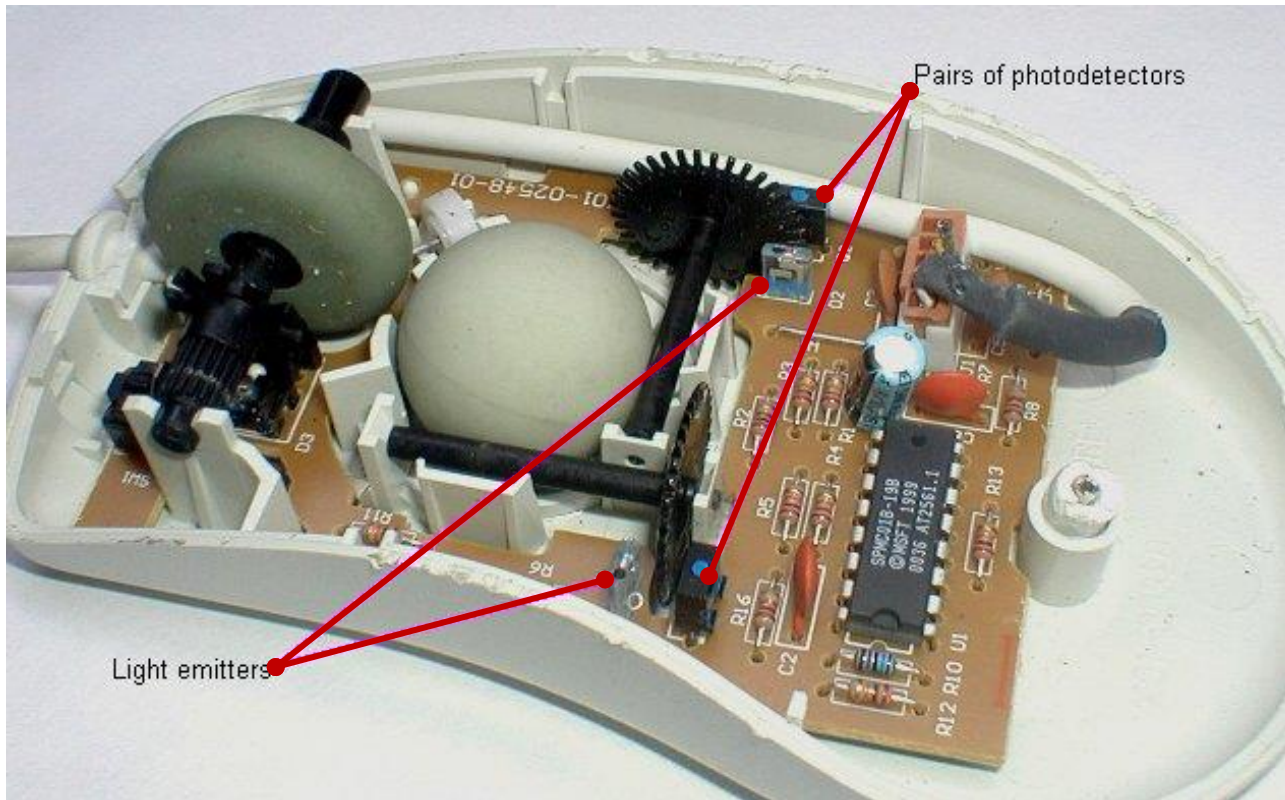


Phantom
Sensable Technologies

- **Resolution**
1000 increments per revolution.
- **Low signal noise**
Signal remains digital. No analog conversion.
- **Contact**
Frictionless. No contact between optical disc and sensor.
- **Cost**
30-40 US\$ for an encoder and counter.

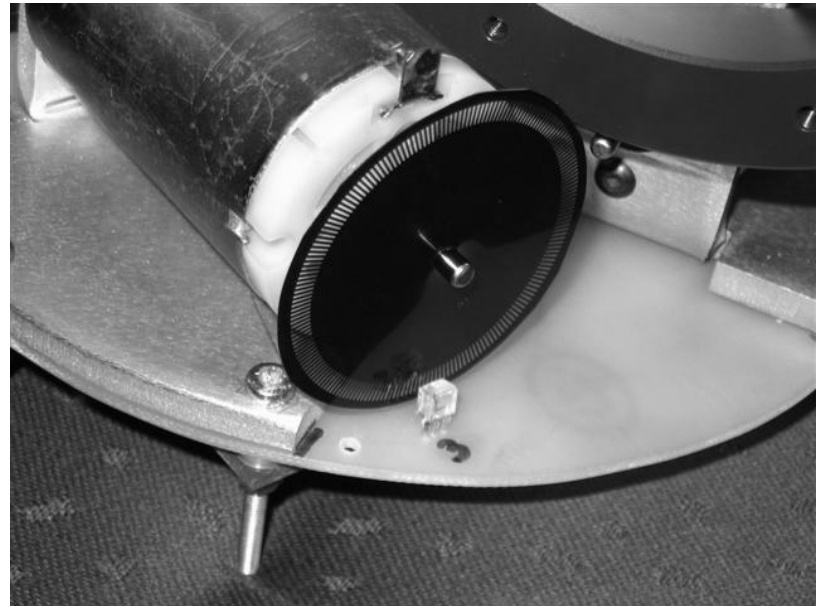
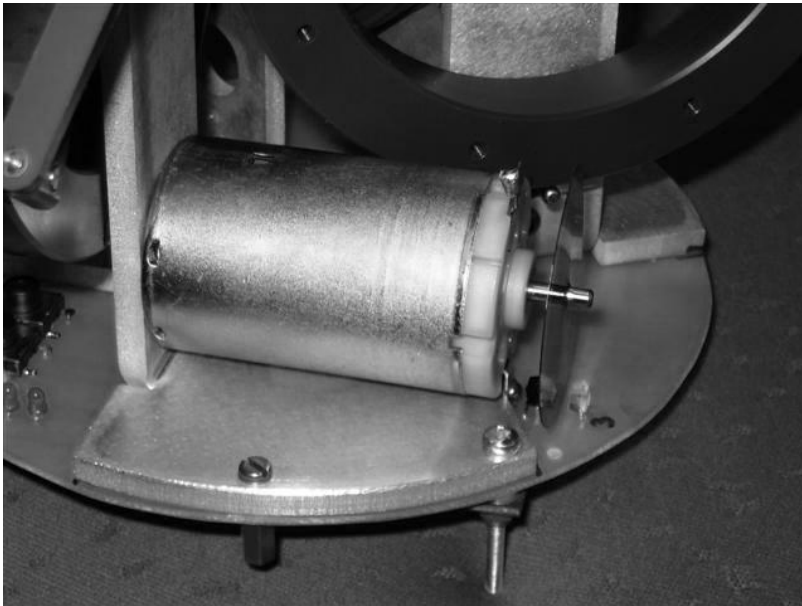
Position Sensors

Optical Encoders



Position Sensors

Optical Encoders



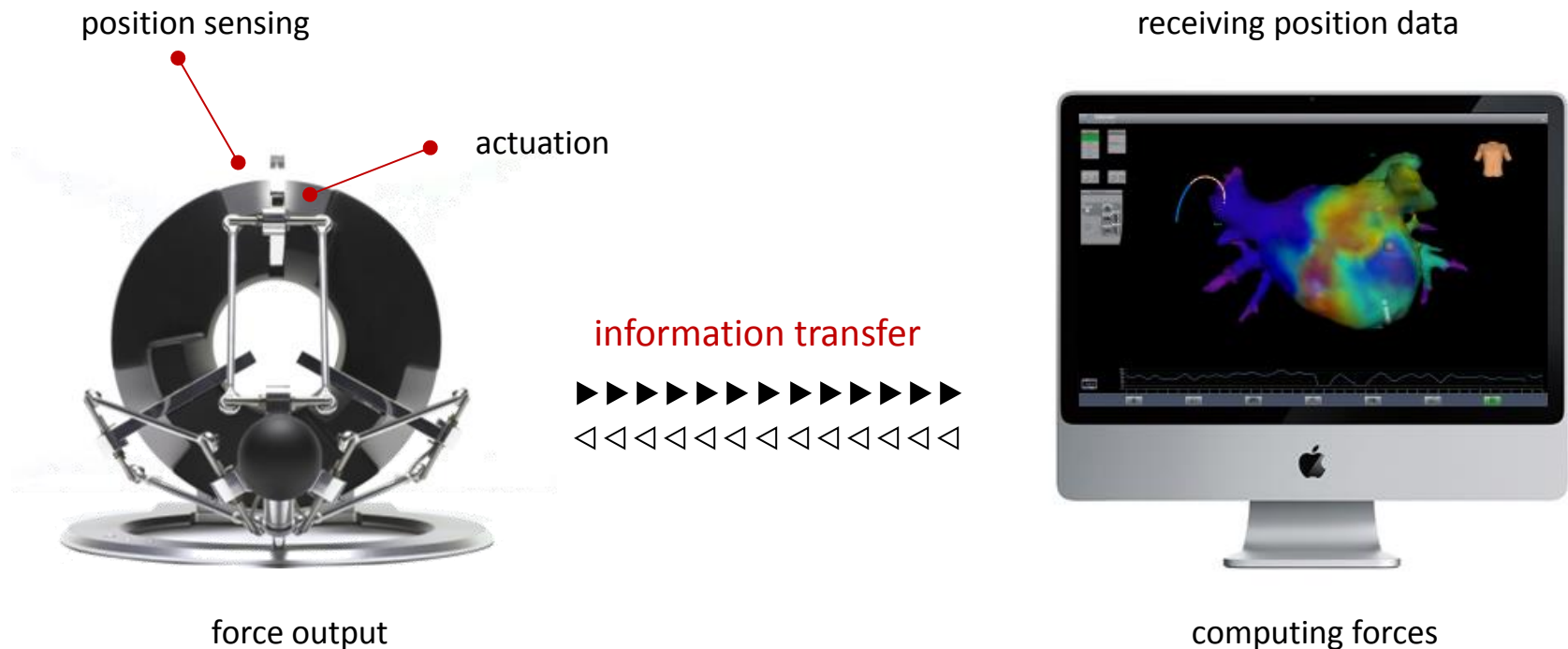
Mechanical Design

Articulated Systems



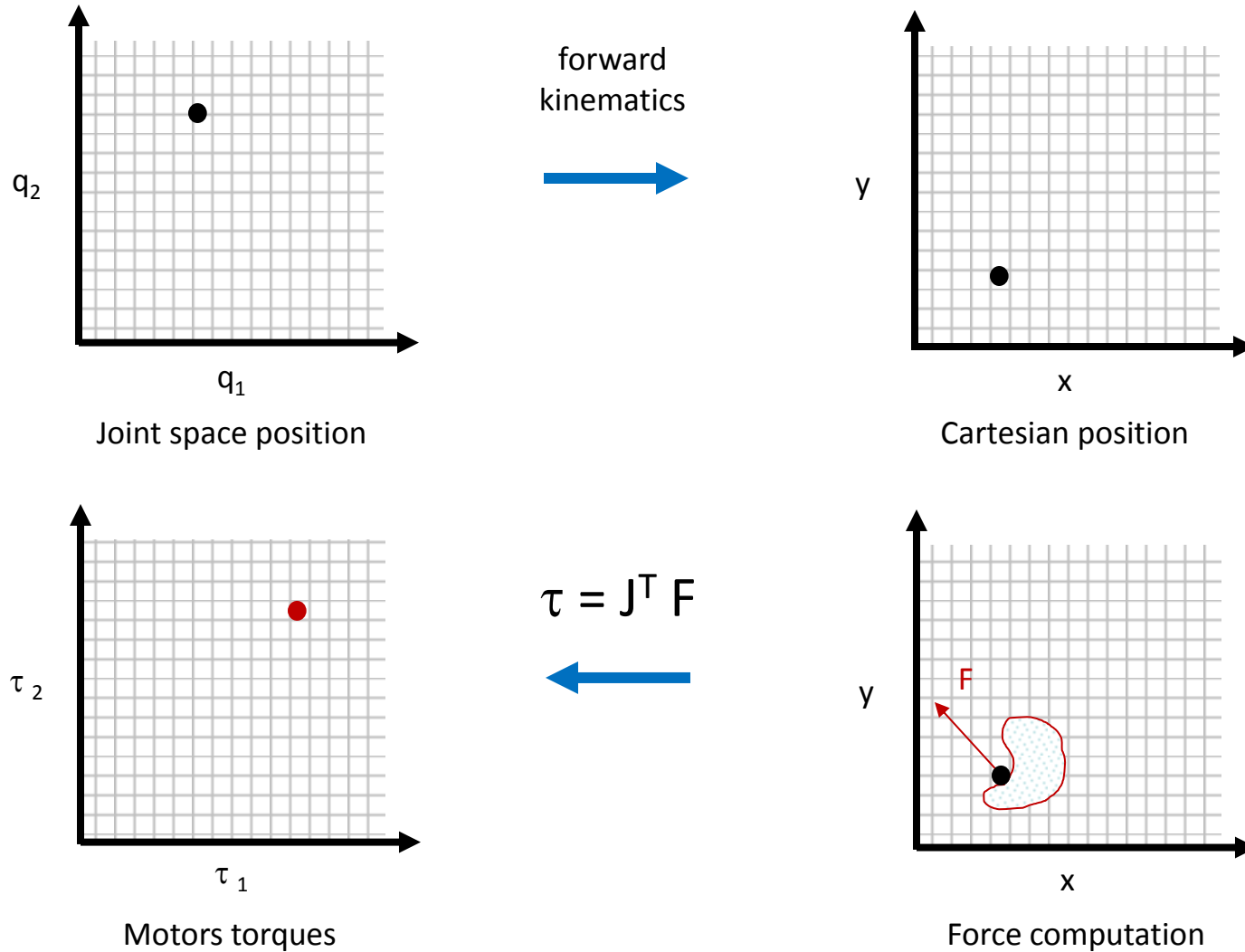
Communication Interface

Information Transfer



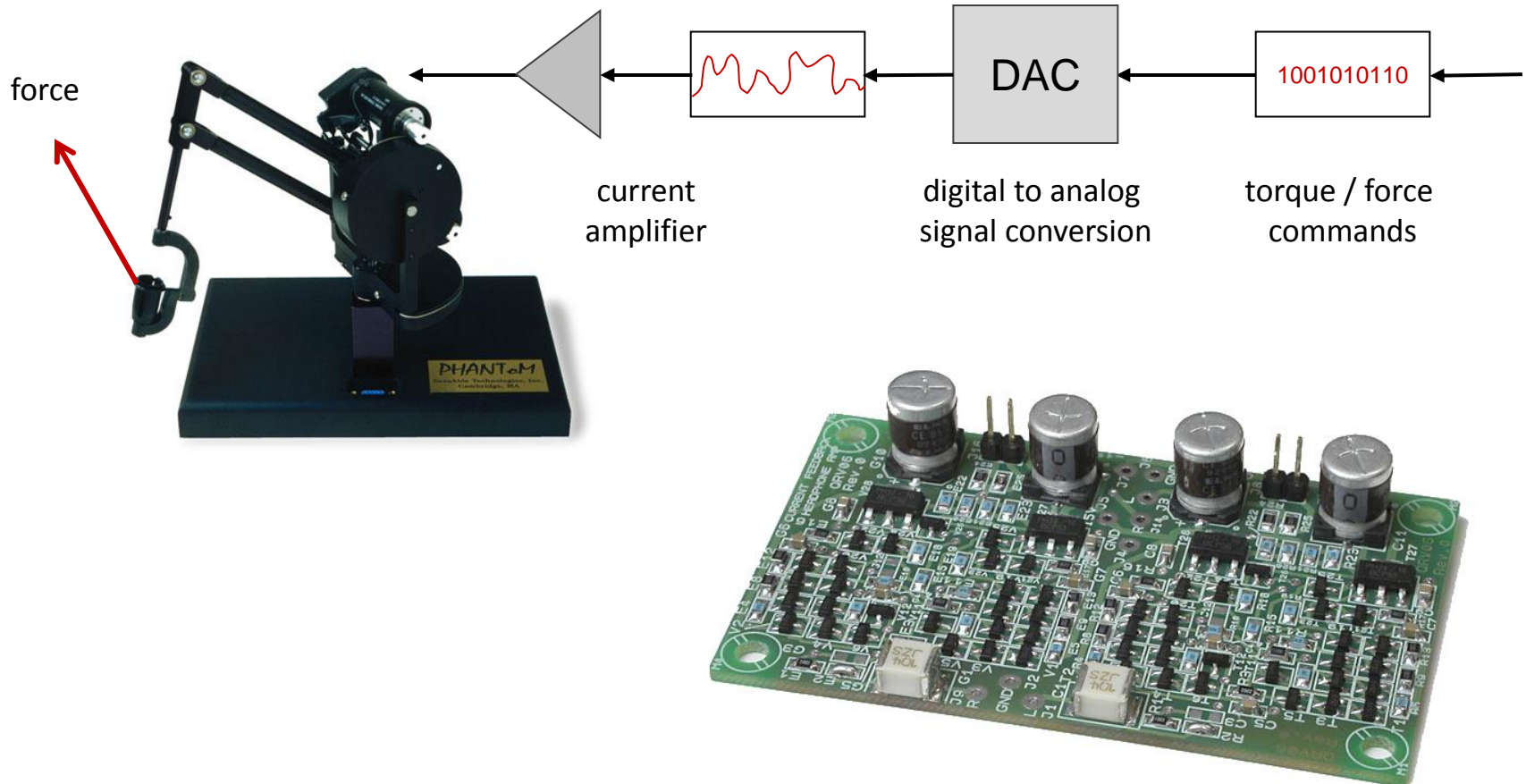
Computation

Position and Force



Actuation Stage

Current Amplifiers



Product Creation

Designing Prototypes

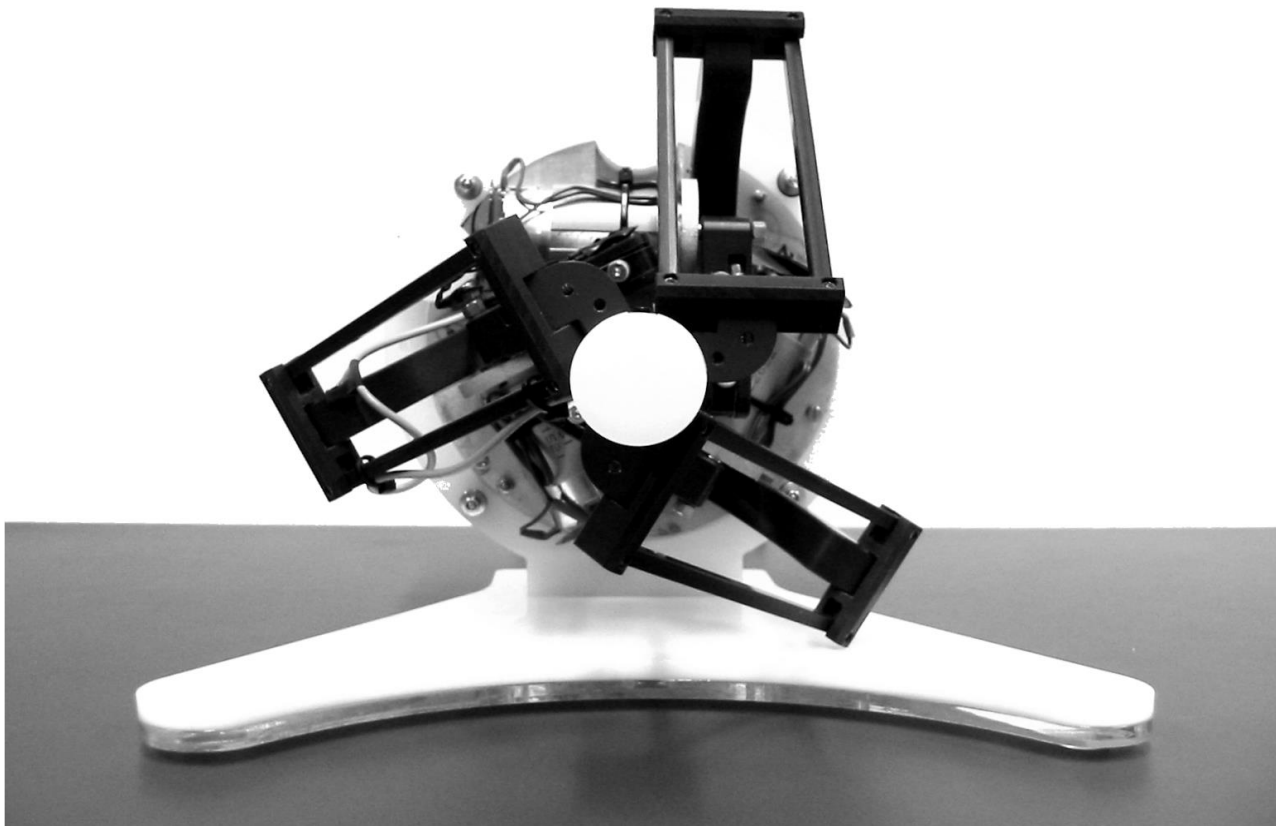


Prototype

Force Dimension, Lunar Design

Product Creation

Designing Prototypes



Prototype
Force Dimension

Product Creation

Industrial Design

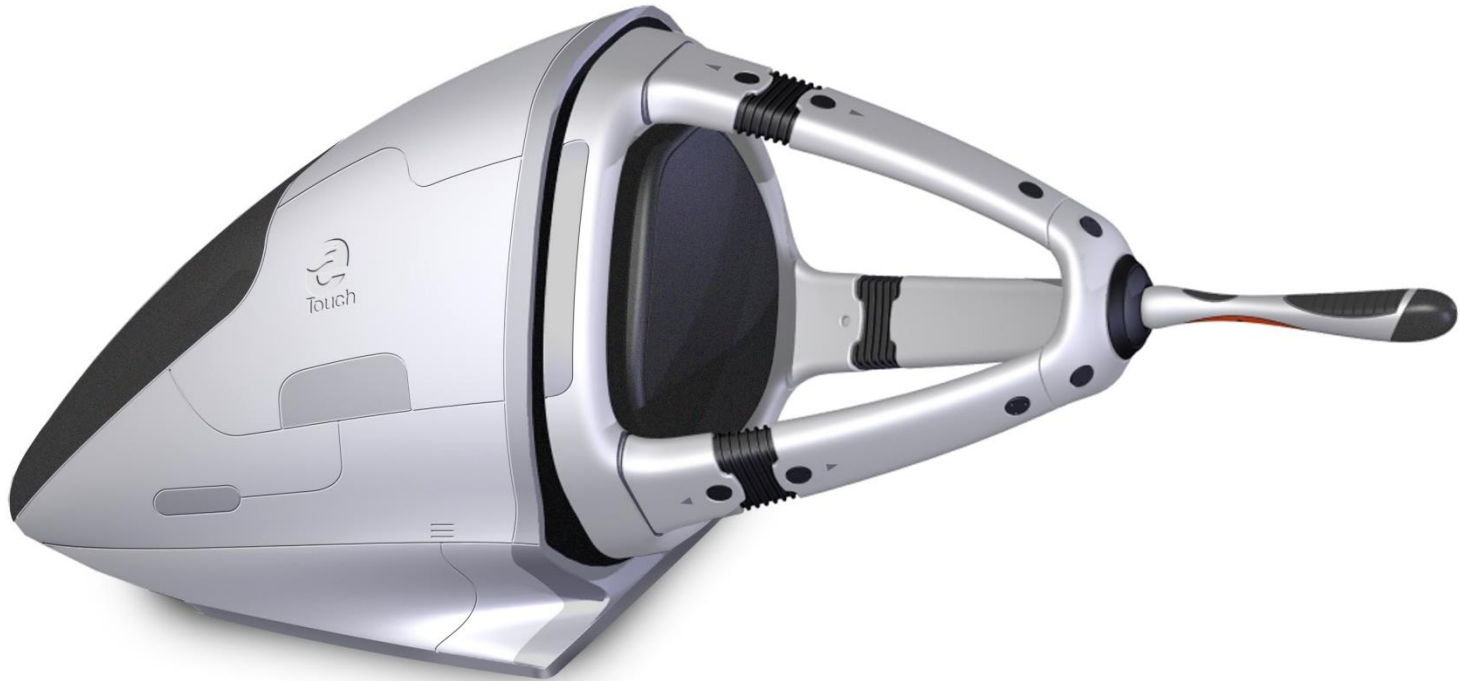


Falcon

Novint Technologies, Force Dimension

Product Creation

Industrial Design



Product Creation

Industrial Design



Product Creation

Industrial Design



Product Creation

First Production



Product Creation

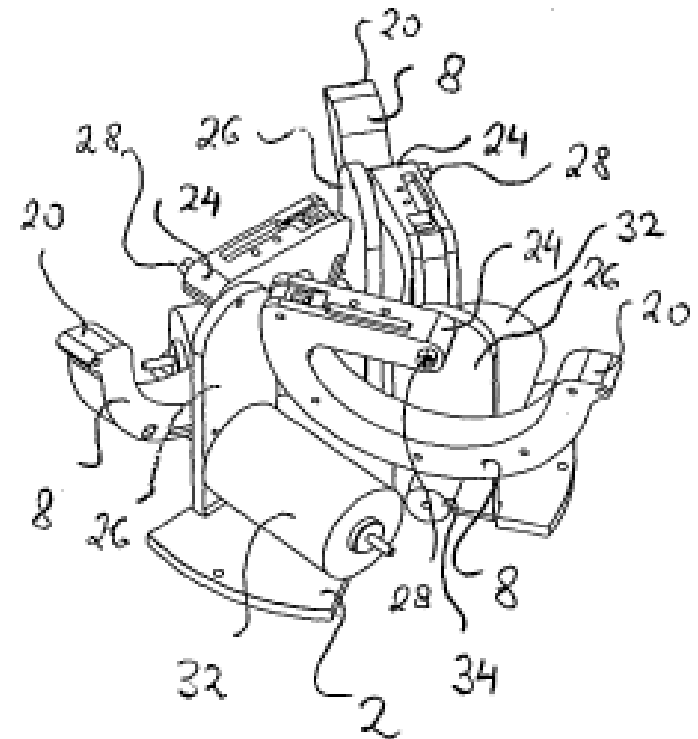
Launching the Product



Patents

Protecting Ideas

	Europäisches Patentamt European Patent Office Office européen des brevets	
(19)	(11)	EP 1 690 651 A1
(12)	EUROPEAN PATENT APPLICATION	
(43)	Date of publication: 16.08.2006 Bulletin 2006/33	(51) Int Cl.: B25J 17/02 (2006.01) G05G 9/047 (2006.01)
(21)	Application number: 05002892.7	
(22)	Date of filing: 11.02.2005	
(84)	Designated Contracting States: AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR Designated Extension States: AL BA HR LV MK YU (71) Applicant: Force Dimension S.à.r.l 1015 Lausanne (CH) (72) Inventors: • Helmer, Patrick 1028 Préverenges (CH)	• Conti, Francois 2072 Saint-Blaise (CH) • Grange, Sebastien 1007 Lausanne (CH) • Rouiller, Patrice 1196 Gland (CH) (74) Representative: Niederkofler, Oswald et al Samson & Partner Widenmayerstrasse 5 80538 München (DE)
(54)	Kinematic chain with an arm comprising a curved portion and parallel kinematics transmission structure with such kinematic chains	
(57)	A kinematics chain (6) for a device for transmitting movements comprising a parallel kinematics transmission structure providing three degrees of freedom, the parallel kinematics transmission structure comprising a base member (2) and a moveable member (4), the kinematics chain (6) comprising a first arm (8) adapted to be coupled to the base member (2) and comprising a curved portion (52).	



Medical Applications

High-End Interfaces



Medical Applications

Building Partnerships



Sensei
Hansen Medical, Force Dimension

Quality Control

Certification and Validation

