

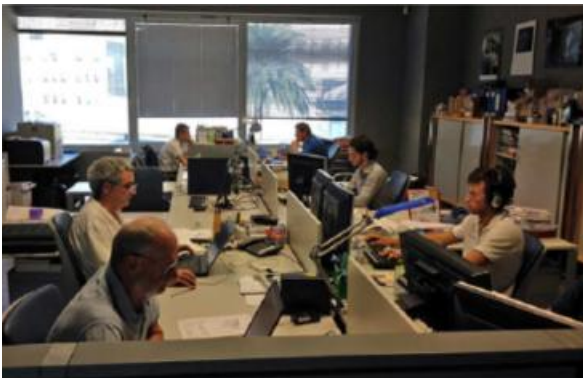
Meet the Supplier Event – Ancona March 22, 2017

MAGIC F4A (FEX for All)

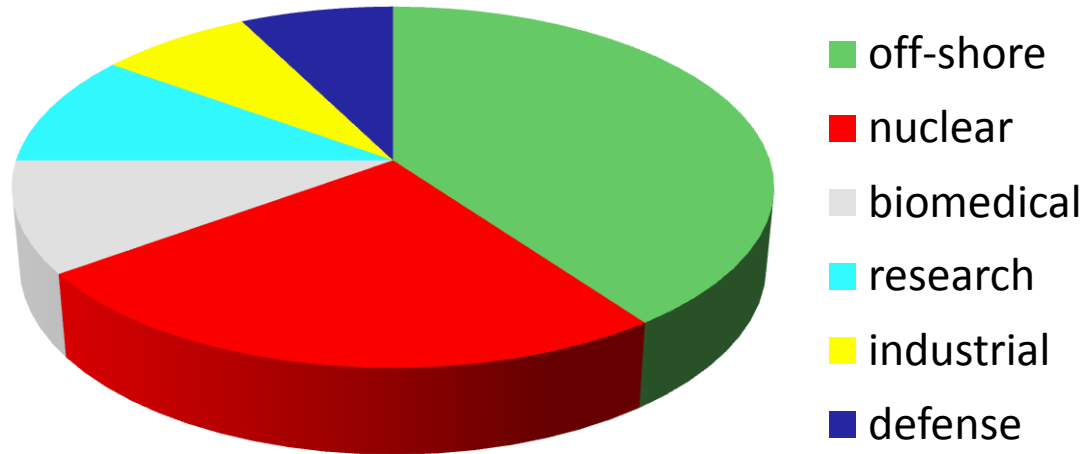
Danieli tlabs in a nutshell

Robot and advanced machines for special applications
From conceptual design to on site installation and service
From prototype to small series production
Integrated development and production

PART the DANIELI HOLDING since January 2017



Our markets



Some customers

Saipem
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Paramed
Intermarine

WASS
MBDA
Enea
IIT

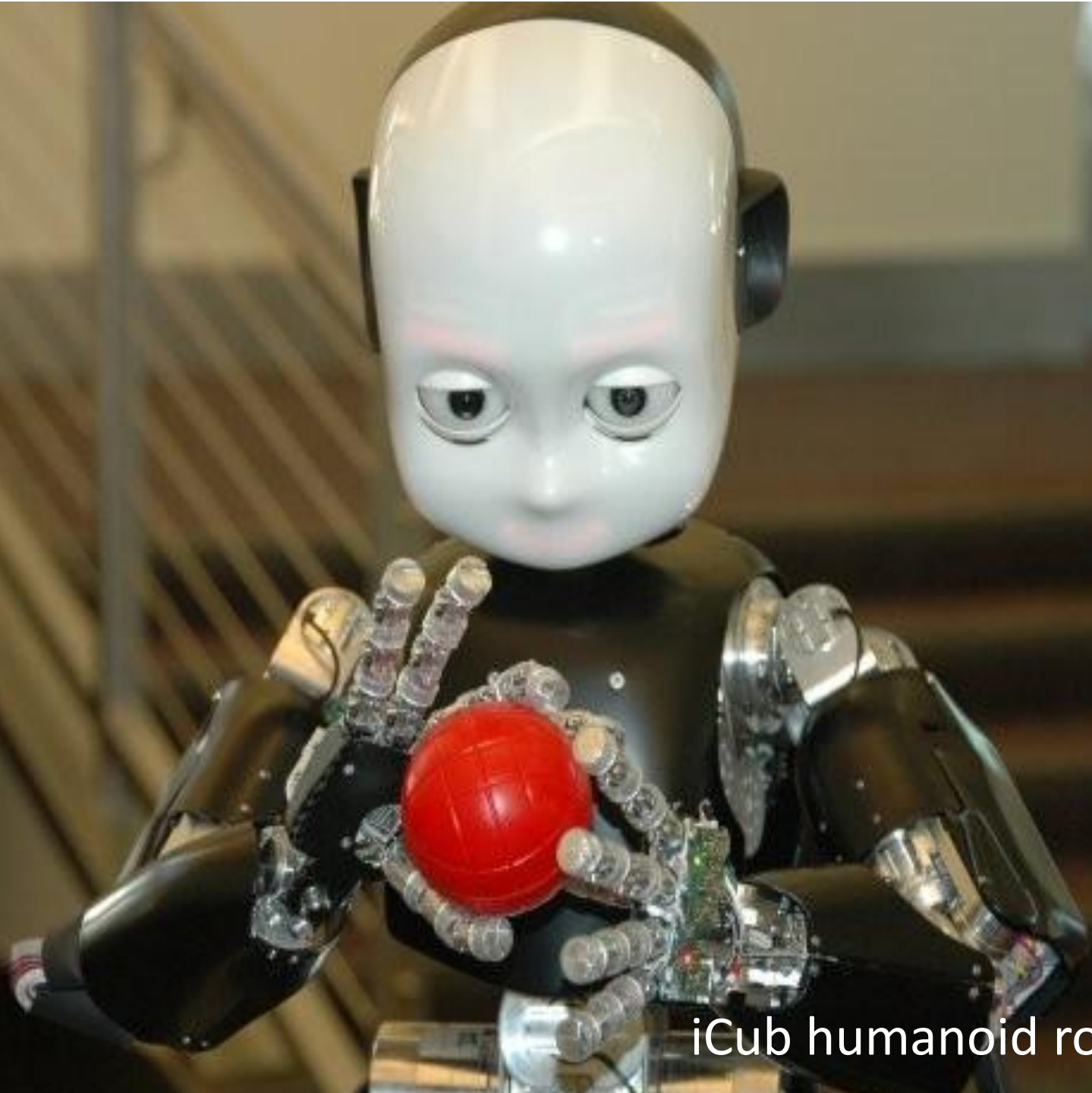
Sogin
Selex ES
ITER Organization

ARAMIS 2+ exoskeleton for upper limb rehabilitation



BIOMEDICAL

RESEARCH



iCub humanoid robot

The Finger Exoskeleton Principle: A bottom-up approach

Everything started from a need to hand functional losses received from rehabilitation/assistance professionals. The need was for a device with the following characteristics:

- ***Wearable,***
- ***4-fingers actuated (with/without the thumb)***
- ***Exoskeleton Glove***

Which should provide:

- **Assistance for ADL tasks**
- **Active Motion: Assistive/resistive forces**
- **Passive Motion**
- **Specific design for managing spasticity**
- **Hand rehabilitation for in/out-patients (tele-rehabilitation)**

F4A: the background - FEX

- The ***FEX*** **Fingers Extending eXoskeleton** is based on the concept of a ***wearable device for rehabilitation***, made of an ***under-actuated and flexible mechanical structure*** directly connected to the hand, designed in such a way that it ***automatically and symbiotically adapts to and follows the mobility of the finger*** (by means of a chain of spring-based differentials that allow some level of compliance and global force distribution among the fingers) with the possibility of a ***natural, bi-directional exchange of forces and reaction forces between the device and the human hand***.

F4A: the background - FEX

- The FEX robot was developed and patented by TelerobotLABS (GE2014A000120 – PTC/IB2015/059313).
- The patent presents the working principle and the potential applications of the ***innovative hand robotic exoskeleton*** for the ***functional recovery of hand*** movements and ***for the assistance in ADLs*** in neurological and orthopaedic patients.

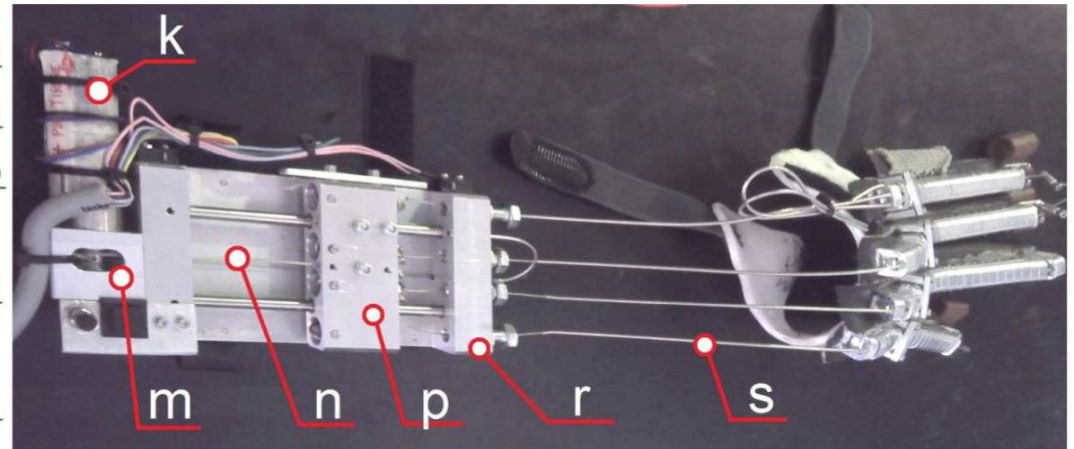
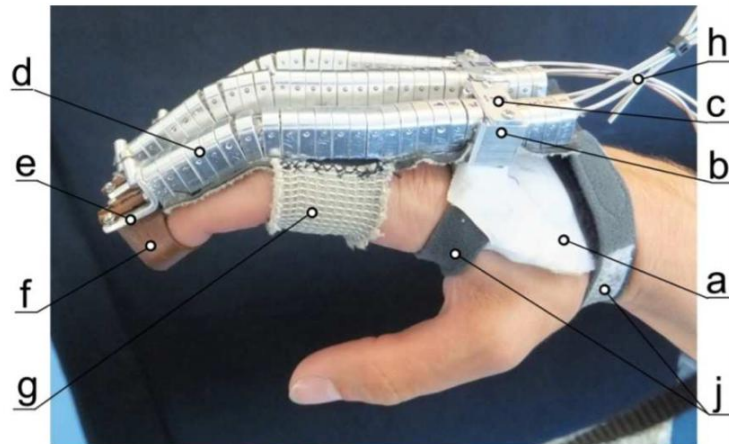
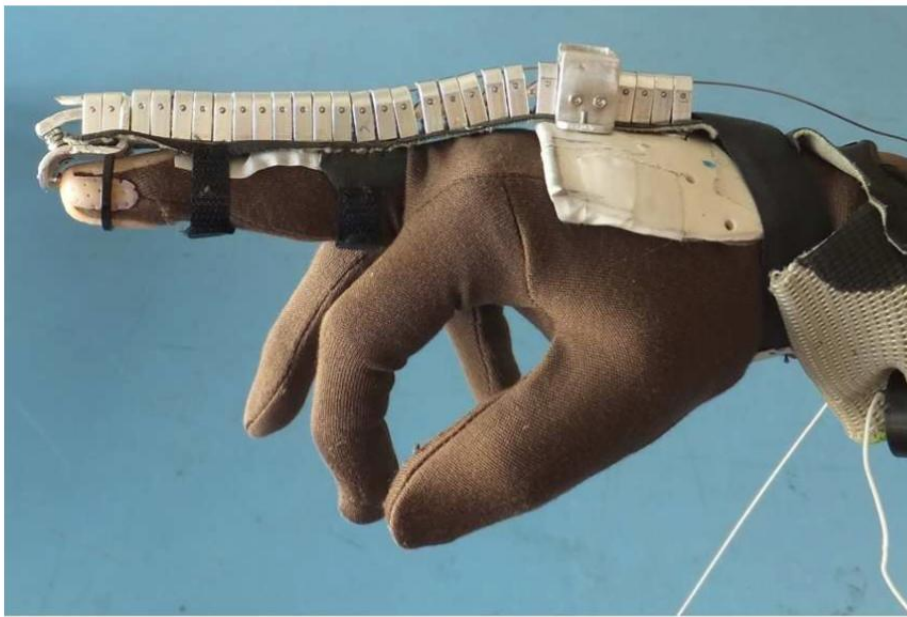
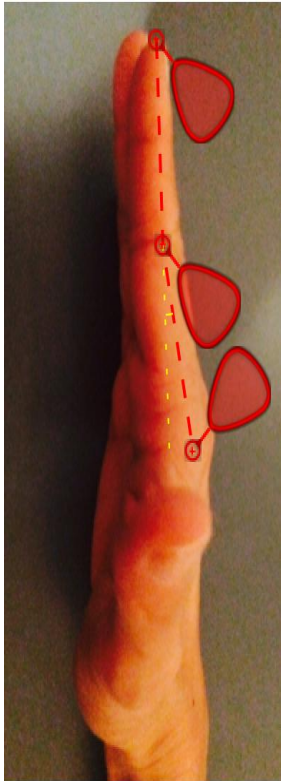
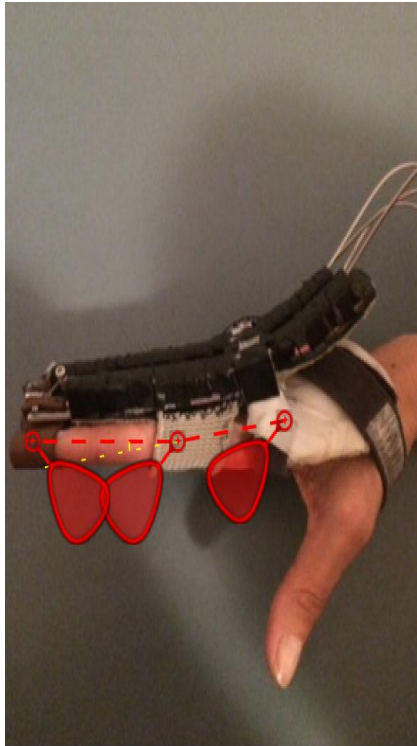


Fig.5. left: FEX on a hand - thermoplastics plate (a), velcro fastenings (j), FingerSpine mounting elements (b, c), FingerSpine (d), fingertip attachment (f), textile loop (g), bowden wire (h); right: FEX actuation unit: DC motor (k), pulley (m), main tendon (n), sledge with springs - one for each FingerSpine (p), wires tensioning module (r), bowden wire (s).



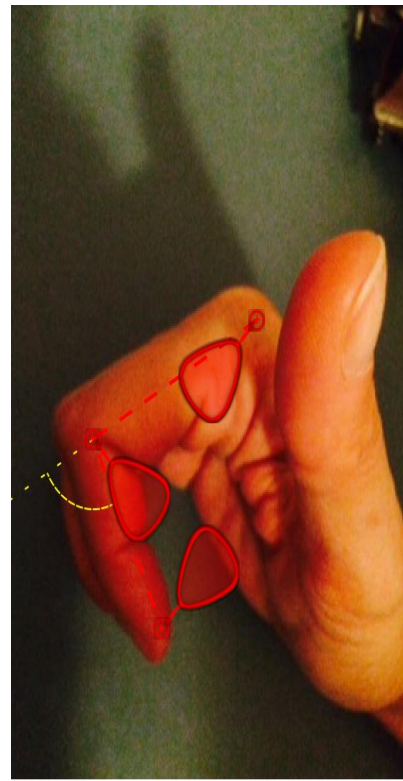
8.9°



Salva

8.3°

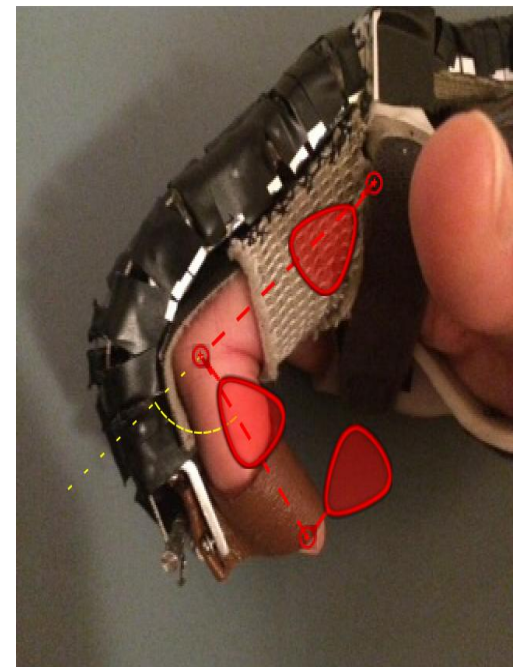
Annu



alva

86.9°

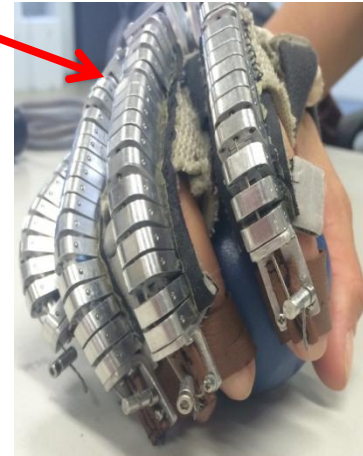
Annulla



Salva

91.2°

Annulla



F4A: Phase 1 Goal

Starting from the same working principle and taking advantage of the ongoing tests on the FEX, the F4A Phase 1 Goal is the design of a new device with the following characteristics:

- ***Wearable***
- ***For both rehabilitation and ADLs assistance***
- **Active Motion: Assistive/resistive forces**
- **Passive Motion**
- ***Low cost (glove made of plastic and by rapid prototyping)***
- ***5-fingers actuated***
- ***Able to both extend and flex the fingers by means of a push-pull cable (one per finger)***

F4A: Ongoing Work

- Tests were ***focused on verification if the exoskeleton principle meets the requirement*** of extending pathological or healthy fingers (torques, velocities) and how much the pressure caused by the FingerSpine disturbs users
- New specifications for the actuation unit were identified (e.g. flexion/extension motion speed increased by three times) starting from the patients' feed-back
- A new design of the actuation unit is in progress, according to the new specifications
- A preliminary design of the finger to be produced in plastic has been performed (porting from original FEX metal prototype)
- The production of preliminary plastic finger in different plastic typologies is in progress – technology tests
- A preliminary prototype of a finger joint movement actuated by a push-pull cable was developed
- The push-pull cable actuation for both extension and flexion is under test

F4A: Ongoing Work



Thank for your Attention!



*You will be amazed with
our technology but don't be
surprised if we will propose
a simple solution*

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