

Category: Medical Equipment

Reference: 1394

ESA: Exoskeleton for the human arm

Space Origin:

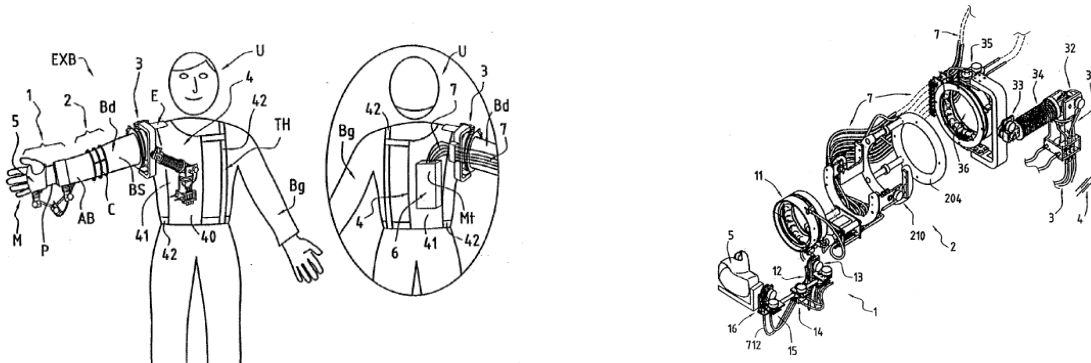
An international institution proposes an innovative exoskeleton that includes a kinematic chain of parallel pivots and comprises a shoulder, a curved and a hand. It has six degrees of freedom, with a support carried by a human operator with rigid front and rear plates. The shoulder is fixed to the front plate and the hand is fixed to a rigid glove on the operator's hand. The active areas are controlled by flexible tendons of cables activated by control units disposed on the rear rigid plate.

Description:

The international institution that proposes this new innovation intends to find partners that can apply this innovative exoskeleton to areas such as security, robotics, medical equipment and other. This innovation relates to a exoskeleton for a human arm. It finds application particularly, although not exclusively, in space technologies. "Exoskeleton" is a term used originally in biology to indicate the envelope outer support of an animal. For example, the arthropods have an outer exoskeleton instead of an internal backbone. In the last period the term was also associated to structural apparatuses intended to be attached around members of persons. Recently still, a new category of apparatuses was added to the family of the exoskeletons: they are mechanisms used, for example, to increase human performances of execution, in robotics or in interactions of virtual reality. To fix the ideas, one will place oneself in the frame of the preferred application of the invention, namely the application with space technologies. In a more precise way still, one will consider the case of the remote control of a robot of type humanoide working outside a space station, for example the international space station. It can be a question, in this frame of application, of the called robot "Eurobot" which is supposed to provide a very precise and skilful means of intervention for the inspection, the maintenance and the repair of hardware in the strongly hostile environment of space. The robot is equipped with three arms kinematically similar with the human arms (i.e. particularly equipped with seven degrees of freedom). For the major portion of time, the robot is programmed to achieve preestablished tasks, but in certain cases the robot must be operated by remote control: maybe by astronauts inside the space station, or that is to say directly by operators remained on earth. In the two cases, the requirement of very precise handlings has imposed the use of different techniques of immersion. For this reason, the operator door of the spectacles video, gloves with return of force and an exoskeleton of arm to feel the sensations of the robot, i.e. those which it would have felt if it had carried out itself the tasks carried out by the robot. The necessity to create an exoskeleton compatible with operators with earth or astronauts is not either without constrained. It is indeed necessary to carry out a lightweight system (typically less than 5 kg), compact and easy to carry.

The arm Exoskeleton is intended to acquire the given movements of the articulations of the arm of a human operator using measuring sensors and apply in feedback with the said articulations of the forces and/or couples using units of activation associated with at least a part of the articulations, characterized by the inclusion of a first device having conformation of a sleeve, intended to be treated as arm (data base), in order to form a kinematics chain of parallel articulations. Such apparatus contains also the exoskeleton subset of shoulder comprising a determined number of articulations associated with articulations of shoulder of the aforesaid operator, a second subset exoskeleton of elbow comprises a second determined number of articulations associated with the articulations with elbow of the aforesaid operator and a third exoskeleton subset with wrist comprises a determined third number articulations associated with the articulations of the wrist of the aforesaid operator. The mentioned units of activation are ordered by flexible tendons running along all the subsets, being mechanically dissociated in order to be able individually to be ordered by such flexible tendons. The all system includes a second apparatus carried by the thorax of the

operator, comprising a front rigid plate for the chest, and a rear, rigid plate of back. The shoulder exoskeleton is attached to these plates providing a fixed reference for any of the exoskeleton movements.



Exoskeleton for human arm

Innovative Aspects:

Although the kinematics parallel of the exoskeleton is different from that of the arm, each posture of the human articulations can be determined in a univocal way by the corresponding posture of the chain of kinematics of exoskeleton. The advantages brought by this approach are numerous and can be summarised as follows:

- The weight of the system is not carried by the arm but by the thorax.
- The complete range of movements of shoulder, elbow and wrist is possible.
- The articulations themselves are simpler and more reduced
- It is not necessary to align the axes of the human articulations with those of the exoskeleton: it follows that no procedure of adjustment along and complex is necessary before the exoskeleton is operational.

Application Areas:

It was developed for space applications, but has great potential for Robotics, Medical, Clear Mines, Bomb Defusing, remote Biological/Chemical decontamination tasks after e.g. terror attacks applications.

Cooperation:

The technology owner is looking for partners for a license agreement.