

**EXOSKELETONS: THE HISTORY OF CREATION AND THEIR USE
TODAY**

students Bobrovich A.O., Charniak V.I.
scientific supervisor – senior lecturer Beznis Y.V.
Belarusian National University of Technology
Minsk, Belarus

Human capabilities are quite limited, and as a result, people's main goal was to come up with devices that would increase strength, speed, and the ability to survive on Earth. With the development of technology new ways of expanding the capabilities of one's body were invented, one of which was the idea of an exoskeleton – an external frame that is a supporting structure, and at the same time, performs the function of increasing the capabilities. An exoskeleton is a robotics product designed to expand the physical capabilities of the human body, reduce the load on the user's musculoskeletal system and replenish the lost functions of the limbs.

Exoskeletons are divided into active and passive. Active exoskeletons are devices usually with electric servos (it is also possible to use pneumatics and hydraulics) that enhance the physical abilities of users, their speed, endurance, strength. They help people lift heavy loads, increase the speed of movement and reaction, allow to move around any terrain. Thanks to various installed sensors, data on the changes in environmental conditions are collected.

Passive exoskeletons are devices that do not require any energy source to function. The principle of their operation relies on the basic laws of mechanics: through the use of counterweights and levers, the passive exoskeleton redistributes the load on body parts. The action of a passive exoskeleton reduces the load on active muscles, on average, about 30%.

Today, exoskeletons are used in a wide variety of fields. The largest number of products are produced for emergency services, medical, industrial areas. In industrial enterprises, passive exoskeletons are usually used. They protect the musculoskeletal system of workers from damage and users can easily perform operations that require a lot of effort without getting tired.

Some active industrial exoskeletons work on the principle of a «third hand». A device is attached to the hip joint, in which a tool is placed. Active exoskeletons also help workers in moving cargo, assembling metal structures and other operations that involve working with heavy products.

Medical exoskeletons are used to facilitate and accelerate the rehabilitation of patients after injuries and illnesses, complex operations, etc. They allow the user to move and hold an upright position, thereby improving blood circulation, restoring metabolism and accelerating recovery. Thanks to exercises with an exoskeleton, pain sensations are reduced, complications are prevented. These devices are equipped with power sources, can be controlled using a smartphone. Patients use the exoskeleton several hours a day. The direction of development of exoskeletons in the medical field is also promising: passive-active exoskeletons, mobile exoskeletons of the lower extremities and pelvis, exoskeletons with adaptive combined control principle will find more and more widespread use. As a more distant prospect for the development of this direction, the use of a combined exoskeleton with a protective spacesuit to work in charged areas or, for example, in space both to relieve the load from a person and to increase it on the muscles of an astronaut in various situations of space flight can be noted.