

Miniature, efficient and intelligent implantable actuators

MPS Microsystems develops miniaturized implantable actuators that support the functions of human body organs. Featuring low energy consumption, these actuators are equipped with an intelligent wireless data transmission and power transfer system.

INFO

MPS Microsystems miniaturized implantable actuators can also be used for applications in the urinary incontinence field.

MPS Microsystems, a subsidiary of the German FAULHABER GROUP, develops and manufactures highly precise and efficient microelectromechanical systems. In the medical field, the company has developed and patented miniature implantable actuators.

His first step here was to minimize regulatory constraints. To this end, the engineering team has developed solutions based on proven technologies in the field of active implants, whether in terms of the metallic and plastic materials used, coatings, manufacturing processes, etc. Despite all the engineering efforts, but especially because of the need to achieve the antagonistic specifications of miniaturization and maximum performance, MPS Microsystems had to resolve to integrate a limited number of non-biocompatible components, which must, of course, be hermetically encapsulated.

Energy efficiency at the heart of design considerations

Wireless connections between an implanted active Medical Device and its external control system are increasingly popular and almost mandatory in any new development. However, the power and capacity of implantable batteries and the low permissible powers through living tissues considerably limit the mechanical performance of implanted Medical Devices.

When the specifications of the implemented Medical Devices require powers at the limit of what the currently available energy sources can provide, the only element the engineer can focus

on is minimizing losses along the entire energy transmission chain. It is precisely in this field that MPS Microsystems applies its expertise, thanks to several decades of challenges taken up on behalf of its customers in order to provide them with systems that are ever smaller, ever more efficient and ever less energy-intensive. Over the years, MPS' "toolbox" has grown with proven tips that its engineers combine to create optimal solutions. It should be noted here that biocompatibility requirements significantly reduce the possible combinations or require ingenious design to meet them.

An extensible, high-performance, integrated and intelligent intramedullary nail

Examples of optimization of energy transmission technologies by MPS Microsystems include an intramedullary nail developed by the company. This nail integrates the electromagnetic wave receiving antenna, electronics, energy storage, motorization, as well as mechanical transmission for elongation. The major challenge of this development was to generate an extension force of 1,200N with an available power of 15mW inside the implant. Why only 15mW? Because the antenna is inside the metal implant and most of the power from the external source is dissipated by Faraday cage effect.

In order to maximize the efficiency of the gearboxes, the largest entropy generators in the energy transformation chain inside the nail, MPS Microsystems had to create a specific design from a biocompatible material and a low friction coating. The transmission of the encapsulated motor torque to the linear elongation system in contact with the body fluid is unperformed by means of a magnetic coupling. MPS Microsystems' implantable miniaturized actuators also have applications in the field of urinary incontinence and heart surgery.

Today, MPS has developed implantable actuators for forces ranging from 10 to 1'200N. If the mechanical performance required by the market will not change in the future, the demands for miniaturization will keep electromechanical Medical Devices manufacturers busy for a long time to come.

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The motorized part of the implant is encapsulated and mobile systems are biocompatible.

