

## THE PROBLEM ADDRESSED

Although technical solutions exist to aid patients and restore their mobility, clinical complications are frequent, and too many patients still give up using prostheses. Prosthetists, lack precise and reliable indicators and are required to review their patients several times before determining an acceptable solution.

Our laboratory has conducted a PhD thesis on the performance of amputee athletes practicing long jump. As part of this research, a device has been imagined to measure the pressure between the prosthesis and the residual limb. The device has evolved to allow an extended application to everyday prosthesis users. Over the past several years, this project has evolved significantly, and a specialized, multidisciplinary team has been formed to further its development.

## TECHNOLOGY

- The device consists of a patch with optical fibers integrating FBGs as sensors, allowing to measure the distribution of pressures in different areas, without hindering the patient's movements. Bragg Gratings enable precise estimation of pressures and shears. A software has been developed to visualize the pressure distribution in real time.
- Different geometries of sensors integrating a different number of sensors have been tested

## COMPETITIVE ADVANTAGES

- Pressure measurements with precision, accuracy and repeatability at the interface between the liner and the socket.
- A connected, robust, non-invasive, flexible, small, easy-to-use device, allowing it to be positioned without disturbing the use of prostheses.
- A device adaptable to different parts of the body, patient populations and pathologies.

## APPLICATIONS

- For the design, selection and fabrication of external orthopedic devices in different hospitals, rehabilitation centers and orthopedic companies.
- For the elaboration and evaluation of reeducation program for physical therapists.
- For the prevention of bedsores and other pressure injuries.
- For robotic grasping.

## DEVELOPMENT STATUS

- TRL 5 : pressure measurement between rigid devices and the body, presenting the data in a clear and intuitive way. We can build sensors of various shape and adapt the software.

## INTELLECTUAL PROPERTY

A patent application is pending.

## INVENTORS & CONTACTS

- Jean-françois Semblat, Professor ENSTA, Head of the Department of Mechanics & Energetics,  
[jean-francois.semblat@ensta.fr](mailto:jean-francois.semblat@ensta.fr)
- Fabien Szmytka, Professor ENSTA,  
[fabien.szmytka@ensta.fr](mailto:fabien.szmytka@ensta.fr)
- Pauline Simon, Engineer ENSTA,  
[pauline.simon@ensta.fr](mailto:pauline.simon@ensta.fr)
- TTO: Julie Dion,  
[julie.dion@ensta.fr](mailto:julie.dion@ensta.fr)

## PUBLICATIONS

- Doyen E., Szmytka F., Semblat J.F. (2023). *A novel characterisation protocol of mechanical interactions between the ground and a tibial prosthesis for long jump*, Scientific Reports, v.13, 5226.

## LOOKING FOR

- Expanding to new use cases
- Investors
- Industrialization / Suppliers partners