Best printing direction for the parts obtained by Additive Manufacturing (Personalized Orthotics)

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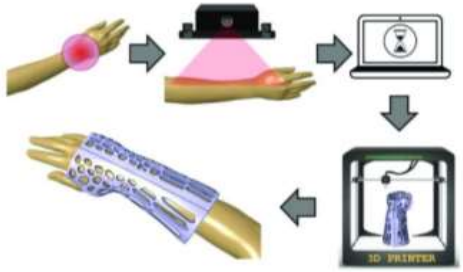
ABSTRACT

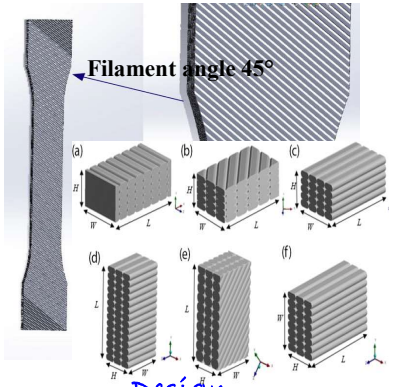
According to World Health Organization (WHO) ("Disability and Health"), about 15% of the world's population lives with some form of disability, of whom 2-4% experience significant difficulties in normal daily functions. There is an urgent need to scale up disability services in primary healthcare. Thus, limb disability is a global public health problem. There are various types of treatments for limb disabilities such as surgical, therapeutic, or **orthotic.**



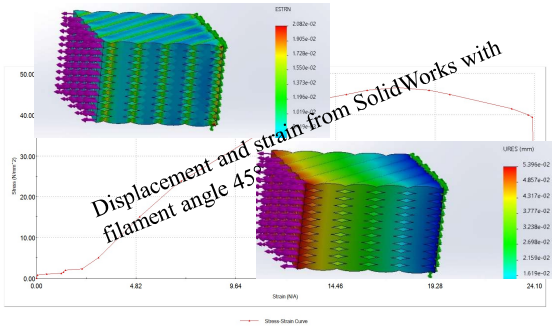
Objective

3D printing technology hold the promise of revolutionizing the quality and efficiency of healthcare. In fact, 3D printing increases the possibilities to produce patient specific devices: orthosis, prosthesis... Ideally, this device should be personalized, biocompatible, comfortable, and safety. **In this Project**, we are interested by the the manufacture of hand orthoses obtained by 3D Printing/AM process and particularly by **the choice of the best printing direction to improve the quality, the safety, the efficiency and the mechanical properties of the orthotic**. For this a **numerical and experimental investigation** is imposed.

Numerical and experimental investigation



Design



Simulation /Numerical validation

Experimental validation

Printing

Problem statement

Different parameters have an important impact on the behavior of the parts obtained by 3D printing: Layer thickness , the direction of build , and printing direction (0°/45°/90°). Focused on the effect/impact of the choice of the printing direction on the mechanical properties/behavior, a **numerical and experimental investigation** is conducted: The SolidWorks program is used to design the specimen on which the tensile test will be conducted to calculate the tensile strength at which the specimen will fail and also to calculate all the mechanical properties and then to draw a Stress-Strain curve. A 3D printer (FDM) is used to print the specimen. Tensile test machine is used to perform a tensile test on the specimen, which has been designed on SolidWorks and then printed in 3D. After conducting the tensile test, the tensile strength, refraction, elasticity, and elongation would be calculated. At the end, the **best printing direction** would be concluded.

Our work is in progress... The Objective is to develop an assistance scan-to-print tool that deliver a 3D printed devise from an acquired scan for individual patients.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References

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- Torrado, A.R. & Roberson, D.A. (2016) Failure analysis and anisotropy evaluation of 3D-printed tensile test specimens of different geometries and print raster patterns, journal of failure analysis and prevention. https://link.springer.com/article/10.1007/s11668-016-0067-4