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DESIGN OF A NEW PROSTHETIC FOOT WHICH COMPLIES WITH ISO 10328 AND ALLOWS HIGH PERFORMANCE

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Introduction

Dynamic elastic response prosthetic feet, made of carbon fiber are available on the market since ’70. In the last years improvements in materials and manufacture technologies allow to increase product’s performances.

The carbon fiber allow to store energy during the first stance phase and return it during the push-off phase.

Prosthetic feet must be, therefore, highly dynamic to allows a good roll-over and support the amputee in walking but at the same time they must be resistant to comply with the high standards of ISO 10328.

This standard consist of 3 kind of tests:

- static tests: 1 static proof test at 1610 N both on heel and forefoot, and 1 ultimate strength test at 2415 N on heel and forefoot;
- one cyclic test at 1330N for 2*10^6 cycles
- one static test in torsion at 50Nm.

These loading condition are higher 3 times than those during normal walking while the loading condition in the cyclic test is closer to the real condition.

To analyze the performance of a prosthetic is useful the hysteresis curve obtained from deformation and load data. The area between loading and unloading curves represent the energy loss which do not aid the final push.

Load-time and deformation-time graphs identify the mechanical strength characteristic of a prosthetic foot.

The Roadwalking foot has a completely new design, 4 laminate to support the user and store and return energy during the whole stance phase, and give an effective propulsive push-off.

The elasticity of this new foot do not makes it weaker: FEM analysis, in fact, was useful to find out a stratification which provide both stiffness and elasticity.

The Roadwalking foot comply with ISO standard and it’s CE marked.

Figure 1: Roadwalking foot

Preliminary results

The new prosthetic foot is been tested with the configuration showed in figure 1.
The results of Ultimate Strength test on the forefoot are showed in the figure 2 and 3 below.

Figure 1: Configuration of testing set-up

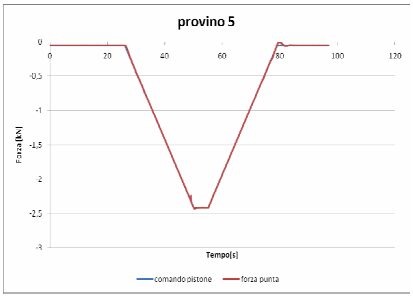

Figure 2: Load-time for Ultimate Strength test on forefoot

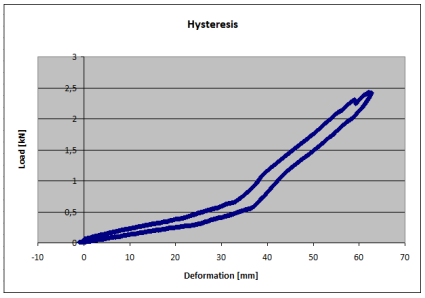

Figure 3: Hysteresison Ultimate Strength test on forefoot

The following graphs show Load and deformation during the cyclic test on both heel and forefoot.

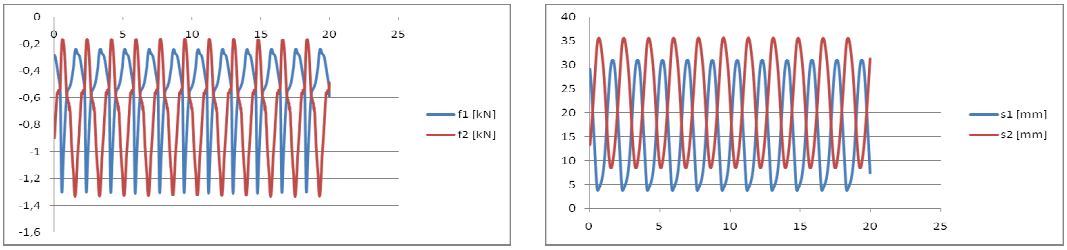

Figure 2: Andamento delle forze (a.) e degli spostamenti (b.) durante la prova di fatica a 400˙000 cicli

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