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## Multi-Purpose Prosthetic Leg

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# MULTI-PURPOSE PROSTHETIC LEG

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## Situation:

- Growing need for prosthetics in the world
- Prosthetics need to be developed that demand as little change as possible in user's lifestyle
- Current prosthetic legs do not allow multi-functionality in their usage
- Three main areas of focus: usability, structure and design

## Usability

### Problems:

- Biocompatibility of prosthetic material
  - Skin allergies
  - Stump Edema Syndrome
- High cost of prosthetic material

### Solutions:

- Better fitting prosthetics
- Using natural biocompatible material at the interface
- Replacing high cost materials in prosthetics with low cost alternatives



Figure 1 (Credits: www.opcareers.org)

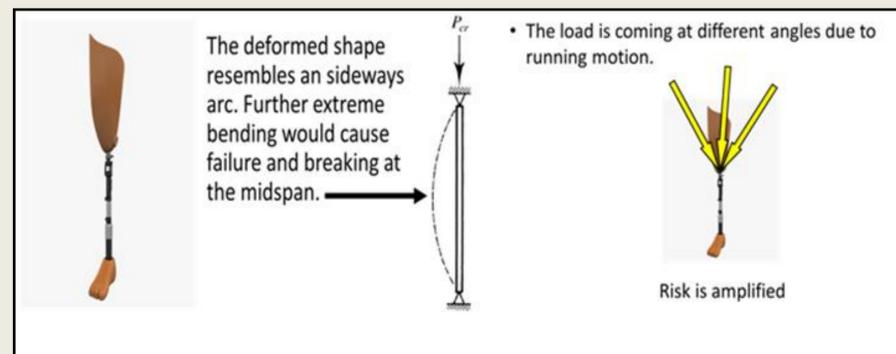
### Evaluation:

- Better fitting of the prosthetic at the socket ensures better skin adaptation [Figure 1]
- Implementing natural bio-compatible material for the socket design improves performance and reduces costs
- Using lower cost alternatives makes it more affordable for people in need of prosthetics all around the world

## Structure

### Problems:

- Half of the athlete's weight needs to be carried by the prosthetic leg
- Non-vertical load
- Greater chance of bending, leading to flexure [Figure 2]



Figures 2 & 3 (Credits: Hibbeler's Mechanics of materials 3<sup>rd</sup> ed.)

### Solutions:

- Highly irregular shape [Figure 3]
- Pre-deformed structural element
- Thin design made from composite



Figure 3

### Evaluation:

- Foot has a high surface area giving better load transfer to the ground
- Able to perform at any angle whether tilted or upright making it perfect for athletes
- Thin shape saves material, providing economic practicality

## Design

### Problems:

- Most prosthetic leg users face restricted movement
- Lack of multi-functionality with basic prosthetics



Figure 4 (Credits: www.bbc.co.uk)



Figure 5 (Credits: boydfuturist.wordpress.com)

### Solutions:

Three components

- One prosthetic leg with multiple bases
- Latch and lock system
- A kit with all the necessary gear that is easy carry

### Evaluation:

- Convenient to carry
- Easy to use
- Ability to enjoy multiple sports
- Appendage can be changed with ease

### References:

- [1] R. C. Hibbeler. (2010). *Mechanics of Materials* (3<sup>rd</sup> Ed.) Upper Saddle River, NJ: Prentice Hall.
- [2] American Academy of Orthotists and Prosthetists, "O&P Trends & Statistics," *American Academy of Orthotists and Prosthetists*. [Online]. Available: <http://www.opcareers.org>. [Accessed: Nov. 18, 2013].