



الهندسة مرتبطة بالسلامة



Al-Mustaqbal University

Collage of Engineering

Prosthetics and Orthotics Engineering

Third Stage

PROSTHETICS II

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Transfemoral Prosthesis

Socket Materials



Polypropylene is a commonly used socket material today. It is relatively inexpensive and easy to manufacture.

Laminated sockets are the most common type in developed countries. They can be made using fiberglass or carbon fiber, making them thin, lightweight, and strong. However, the resins and materials used in these regions are costly and often not readily available in developing countries.

Flexible sockets are also widely used. The inner total-contact part of the socket is made from thin polyethylene, urethane, or other flexible materials, molded directly onto the cast. Around the flexible socket, a framework is constructed to bear the weight. The outer rigid shell is very strong in major load-bearing areas but is cut away in soft tissue regions. Patients often appreciate the comfortable, “soft” feel of this type of socket.

Transfemoral Prosthesis

Shin Component



1. Endoskeletal Shins

Consist of a central pylon that connects the knee to the foot and provides structural support for weight-bearing.

Materials used:

- Steel tubes: strong, inexpensive, but heavy.
- Titanium & carbon fiber: strong and lightweight, but very costly.
- Aluminum pylons: moderate in weight, strength, and cost; suitable only for patients under a certain weight limit.

Advantages: continuously adjustable.

Disadvantages: imported endoskeletal units are usually expensive.



Transfemoral Prosthesis

Shin Component



2. Exoskeletal Shins

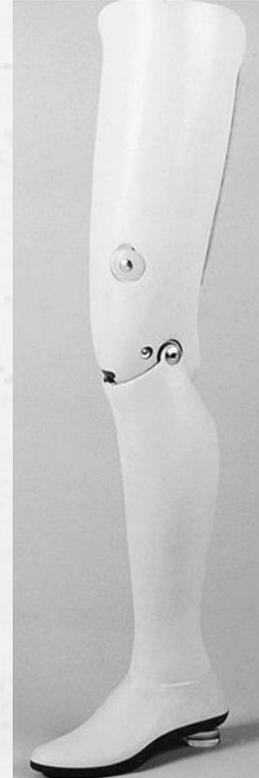
Traditionally, aluminum shins have been widely used in developing countries, but their use has declined.

Aluminum is hollow and shaped to resemble the natural leg.

Advantages: fairly strong.

Disadvantages:

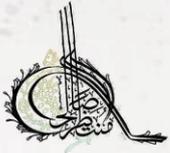
- Requires high manual skill to achieve good results.
- Easily dented, leading to poor cosmetic appearance after a short time.
- Prone to corrosion from sweat.
- Difficult to modify or adjust once fabrication is complete.



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Transfemoral Prosthesis Foot Component

Commonly used is SACH and single axis foot. Young active individual can be given energy storing feet.





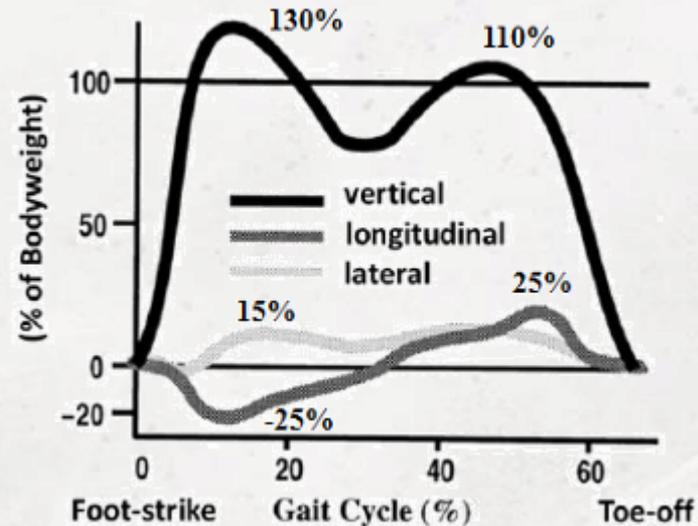
A pylon is used as a part of A –K prosthetic limb. If the subjected load is compressive as shown in Figure, find the dimension of the pylon knowing that the pylon is manufacturing from composite material with ultimate stress of 200 Mpa, factor of safety = 4, and outer diameter of pylon is equal to 1.1 of inner diameter.

for the following cases

1. static loading case
2. dynamic loading case using Gerber relation.

Take yield strength = 0.7 Ultimate strength;

Endurance strength = 0.4 Ultimate strength.





A patient in Iraq is using an above-knee prosthetic socket, which is subjected to stress as shown in Figure. For two types of materials, determine the factor of safety if the ultimate strength is:

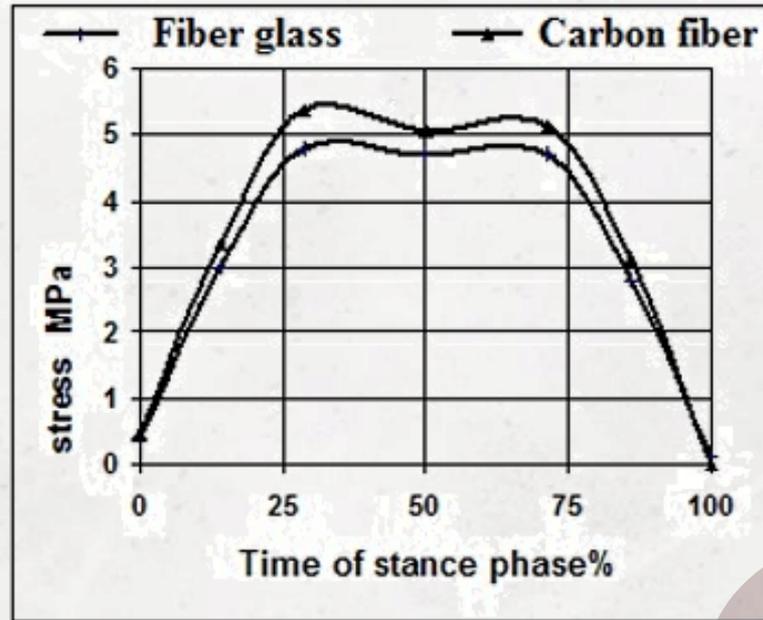
- Carbon fiber lamination: 100 Mpa
- Fiberglass lamination: 75 Mpa

Use the following criteria:

1. Gerber relation
2. Modified Goodman relation
3. Soderberg relation

Assume:

- Yield strength = 0.65 Ultimate strength
- Endurance strength = 0.5 Ultimate strength





A dancer weighing 46 kg takes the arabesque position shown in Figure. Determine the force in her Achilles tendon. Various dimensions concerning the structure of her foot are marked in the figure.

