

Biomimetic Transfemoral Knee with Gear Mesh Locking Mechanism

Researchers at the University of South Florida have developed a knee mechanism which incorporates a flexible cross-linked four-bar mechanism that acts like the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) of a human knee.

The cross-linked four-bar mechanism is accompanied by modified spur gears that are designed to act similar to the femur and tibia at the knee joint. Inventors were able to test a passive mechanism using a rapid prototype model. This is designed to be a cheap biomimetic transfemoral prosthetic knee which can be scaled to match the user's anatomical dimensions.

The flexible cross-linked four-bar mechanism is used to connect the femur and tibia gears. An additional outer link is provided for lateral stability during weight bearing. When weight is applied to the femur gear it locks the tibia gear at full extension and prevents the knee from buckling. The knee stays locked throughout the stance phase and when the user shifts their weight to the opposite side, the knee mechanism is able to swing.

The invention is a biomimetic prosthetic knee which uses a passive locking mechanism with the same cross-linked four-bar mechanism that is used to represent the ACL and the PCL. This mechanism can be adapted for a passive transfemoral prosthetic knee design. The kinematics of the knee are simple and made to mimic the human knee functions. The simplicity of the design makes the knee mechanism inexpensive to manufacture. The design can also be scaled to fit patient's femoral condyle dimensions, and the gears used in the mechanism can enable stepper motor control. Due to the advent of rapid prototyping this device can be made available in all major markets.

ADVANTAGES:

- Simple design
- Highly customizable
- Anatomically scalable
- Biomimetic kinematics
- Can be adapted for actuator control
- Can be used in Robotics

Passive Transfemoral Prosthetic Knee



Rapid Prototype Model of the Biomimetic Transfemoral Knee

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