Development of Multi-DOF High Torque Joints Lightweight Robot Hand with Twisting Spring Wire Drive System

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This research aims to the development of an externally powered myoelectric (EMG) controlled robot hand fit for daily life activities. The myoelectric upper limb prosthesis is a function recovery device for the hand, which demands lightweight, high torque, many degrees of freedom, and viscoelasticity. The hand uses twisting spring wire drive system for drive system, and two wires in parallel configuration for the interference driven joint mechanisms for articulated mechanism.

1. Twisting Spring Wire Drive System

Proposition technique generates movement by twisting a wire by the motor loaded outside the hand(Fig.1). The motors loaded outside the hand, so it's possible to make the hand light. And the wire has the nature of spring by twisting double wires, so this can expect the realization of viscoelasticity actuator.

2. Joint mechanisms

The hand uses the wire driven mechanism at the fingers (Fig.2(a)) imitating the human hand structure. The wire W1 passes through the wire guide that corresponds to the fiber sheath, so the wire W1 can curl not only the DIP joint and PIP joint but also the MP joint. This mechanism allows us to provide MP joint with a high grip power. And, we developed an interference drive joint mechanism at the wrist joint and the thumb MP joint. Fig.2(b) shows the mechanism developed in our laboratory with oil less bearing for the rotating axis forming a guide for the acuators wires, resulting in high torque.

Keywords: Multi-D.O.F. Prosthetic Hand, Twisting Spring Wire Drive System, Interference Driven Link based on Parallel-Wire Mechanism

References

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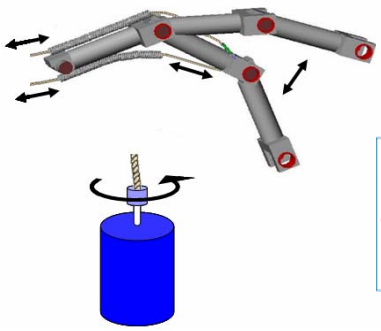

Fig. 1 Twisting spring wire drive system

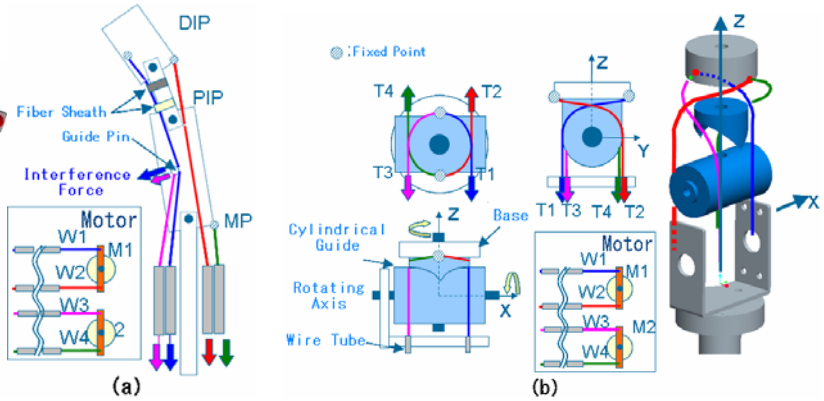

Fig.2 Proposed interference driven finger(a) and wrist(b) based on parallel-wire mechanism.