# DESIGN FINGERS ANTROPOMORPHIC PROSTHESIS HAND AND MOTION CONTROL

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**ABSTRACT**

Work is a presentation make-up mechanism anthropomorphous grab to use especially in prosthetic. It was check a principal functionality designed mechanism finger (drive three axes one string) and make-up a primary model whole hand. And then it was below analyzing possibilities on particular grips. The results should have been using for others works whose purposes should be functional prototype prosthetic setout.

## 1 INTRODUCTION

Word hand has in common talk several meaning. As we simply say hand, according to situation think either:

- whole upper limbs
- hand from carpus to the up tip finger

For specification upper limbs division on two parts:

- shoulder
- hand

From the standpoint function shoulder pursue positional hand. Carpus as connecting link shoulder and hand only limit lay hand. Appearances to the that nature as the best designer will us only very hardly superable is solution in this work standing on identify from biomechanic human hand. Detailed in [1]. How id also told by in [2] solve the problem adaptive grip robotics hands similar humanlike, is very difficult but nevertheless incurrence above all in constructional difference between human and robotics hand.

## 2 COMMERCIAL PROSTHESIS, PRESENT STATE

- Grip handling 2. and 3. fingers together with pollex.
- Both fingers one degree of freedom (forms one part).

- Pollex has one degree of freedom, motion in gear with movement fingers.
- Actuating direct electric motor fed from storage battery.

- Replacement supply fundamental function hand - general grip.
- Fingers are moving opposite pollex, function similar pliers.
- Force grip is max 100 N on the tip fingers.
- Opening mechanism is max 90 mm.

**Fig. 1:** *Electric hand Otto Bock*

## 3 PRINCIPLE DESIGNED MECHANISM AND ITS CHARAKTERISTICS

Variant so-called "with string and spring" was chosen by virtue of analysis presentation in [1]. For concrete characteristics using at simulation and calculation again cite on [1]. Force F is fetch by the help of string. For drive all five fingers was thinking only one engine and the forces are division by the help of lever. Perhaps would be also alternate single drive for every finger. (will article by other working).

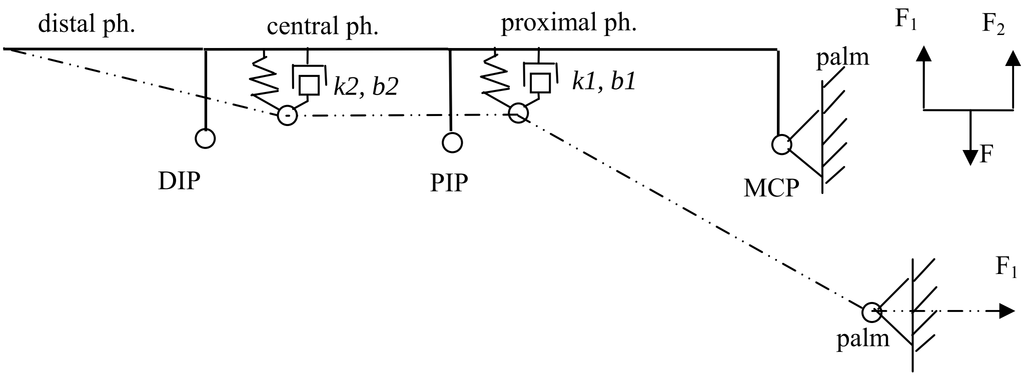


**Fig. 2:** *Diagram variant with string and by two spring*

For demonstration behavior mechanism here is state speeds graph single tip fingers. How is see happen to in sum large alterations. (strains) which naturally put on to force actuation (see [1]). To be sure is possibly take in consideration that the model was assemblage without friction in singles joints and damping which will be at real model due elastic glove.

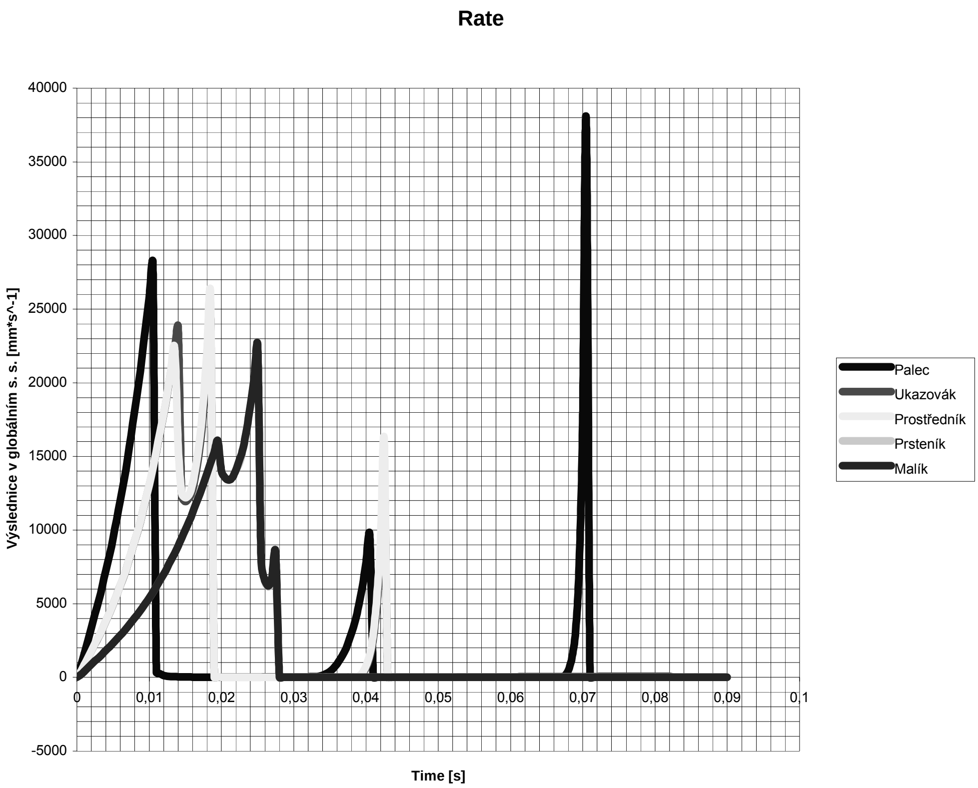


**Fig. 3:** *Rate point on the tip fingers on motion mechanism from outer position opening to the total contraction*

The characteristics them was achievement calculation on computerized model are following:

- force at the tip finger rectification finger ( index finger):

  73.7 N
- force at grip:

  220 N (force palmar grip)

  124 N (pinches grip)
- time from total opening to the total contraction is theoretically 0.1 s practically it will less but did not have been discuss for a longer time beyond 1.5 s
- value mass mechanism without electronics (calculated from system Pro/Engineer) is around 400 g

- mechanism is from principle capable all fundamental grips (their realization will dependent on quality control)
- its has only about one step freedom less as human hand, leave out cylindrical joint on pollex (inexpressive rotation) and carpus, so 19 degree of freedom

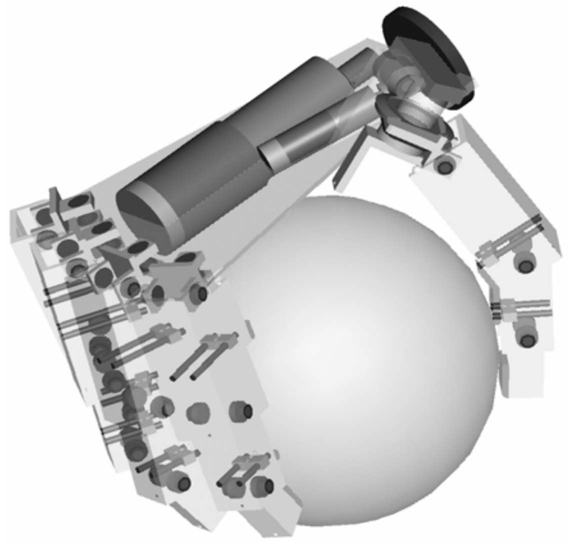

**Fig. 4:** *Grip ball (10 cm diameter)*

# 4 CONTROL AND FEEDBACK

## 4.1 CONTROL

Control prosthesis by will, we can speculate some few possibility scan input signals from patient body and it scan changes:

- Nervous potential by microchip implanted on amputee nerve.

  Acceptable solving; project. research very exacting.

- Nervous potential by needle electrode.

Danger of infection; necessity accurate puncture. It is impossible for use number electrode.

- Nervous potential by surface electrode.

  Exacting interpretation. Signal distortion owing to disturbance.

- Muscular potential by needle electrode.

  Danger of infection but relatively exact terms scan.

- Muscular potential surface electrode

  Relatively exact terms but exacting processing.

## 4.2 FEEDBACK

For full control motion prosthesis is possible use feedback which can be:

- Visual

  Patient self by sight take control of position and gripping prosthesis.

- By rote in contact amputee hand and prosthesis.

  e. g.: placement vibrating facet between stump and snub bed.

- Direct communication with handicap nervous system.

This variant was be ideal but we must take consider all disadvantage electrode applicable for communication with nervous system. There we would introduce and so-called osseoperception (sensibility in bone marrow) when after overgrow screw-bolt to the scrag (so-called osseoperception; overgrow continuation perhaps half-year) and with by other operation is patient capable sense prosthesis as part of your bodies and even and discriminate basis on which stands. (this finding was assumed from application prosthesis leg [3])

- Feedback by patient experience.

From engine sound, vibration construction and visual verification presume to state and position prosthesis.

How is see from previous summary and from world-wide development is probably optimal in other works inscrabe by myosignals.

## 5 CONCLUSION

Introduced numerical results in [1], statics, kinematics, dynamics and stress analyses choice part mechanism are rated behind enough simplified premise (failure resistance, force of gravity, dynamics drive, geometry is modelling without regard to singularity). This result has somewhat tell one's story character. However is from themselves possible trace up what properties will has mechanism in reality. Validity these results would had verify experiments on the prototype whose make is in beginning in the same way anyhow thinking above control and application prosthesis.

## REFERENCES


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