

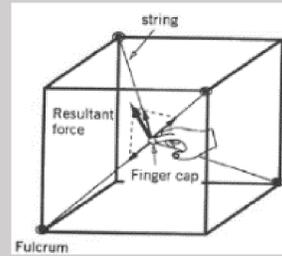


Abstract. We have proposed a grounded haptic display using fishing rod to realize a large workspace. To control this display, we need to convert from the position of the user's fingertip and magnitude of the force to the necessary winding force of the thread and the posture of the fishing rod. Therefore, we developed a control method and evaluated by considering a case wherein the force to be presented is exerted in the vertical direction.

Background

Grounded type[1]

- Strong and accurate force is generated
- Range of the force to be presented is limited within the cube



Wearable type[2]

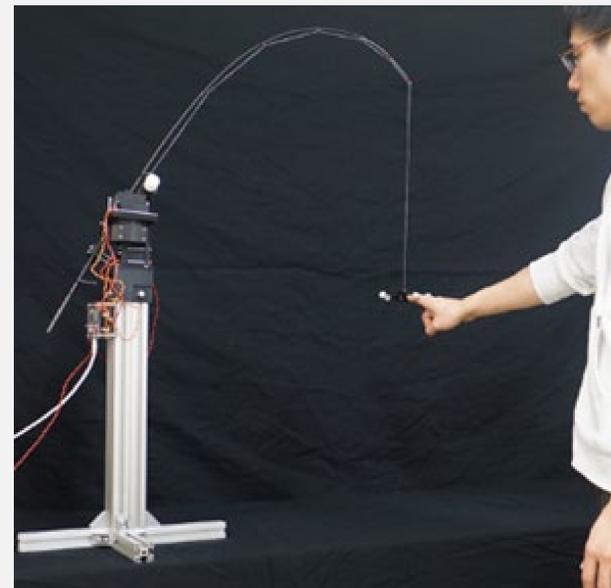
- Force sensation can be exerted is wide
- Reaction force is inevitably generated in the mounting part



Requirement

1. Suppressing the generation of the force to a position except for the intended position
2. Preventing the interference between the body and the threads
3. Presenting a force sensation within a wide range

Proposal



Haptic display using fishing rod

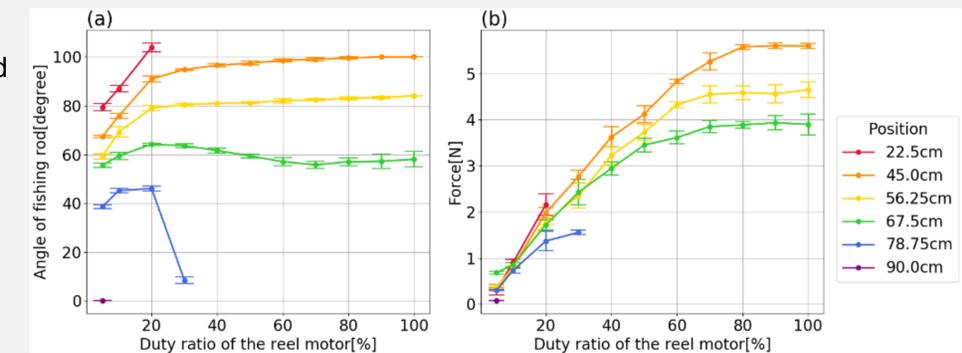
Solutions

1. Grounded type
2. Using one thread from the fishing rod
3. Driving the base of the fishing rod

Result

(Left) Relationship between θ and d
(Right) Relationship between f and d
(Color refers to position x)

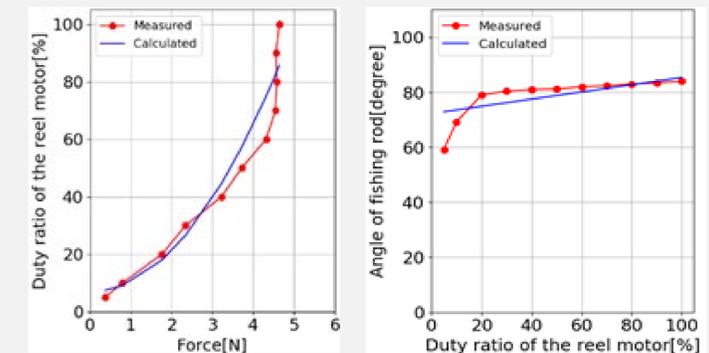
The closer the load is to the display
(a) The better the angle of the fishing rod
(b) The better the magnitude of force



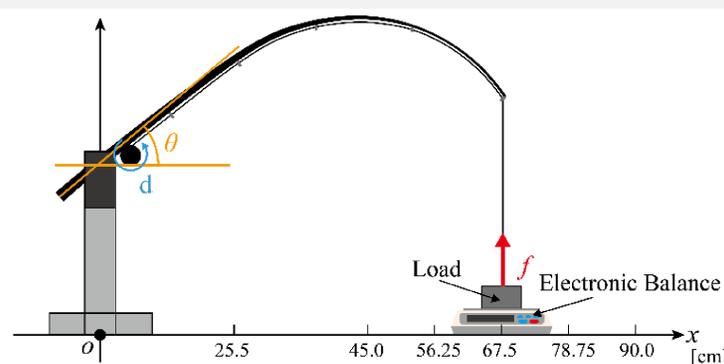
Analysis

Derivation the regression equation from the result
• Comparison of the regression equation and the measurement data (56.25cm)

Be able to derive the winding force of thread and angle of the fishing rod from the position of the load and magnitude of the force



Measurement



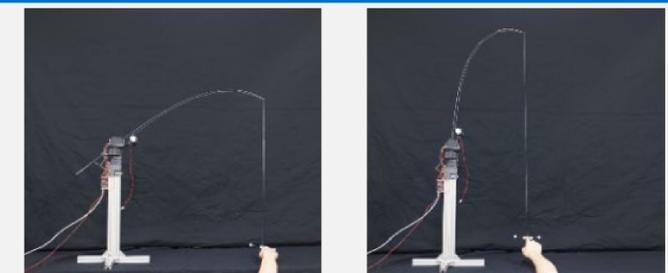
Input : Position of the load x
Magnitude of the force f

Output : Angle of the fishing rod θ
Winding force of thread d

Investigate the relationship between input and output
• Target direction of the force is fixed to be vertical

Validation of control

It is always possible to pull the fingertip in the vertical direction, even if the fingertip is moved



Future work

We will clarify the space wherein an accurate force direction can be reproduced, and the space wherein the force direction cannot be reproduced but the force amplitude can be reproduced
- How much the wrong force direction affects the perception of force sensation?
We will investigate how much the softness of virtual objects be represented