

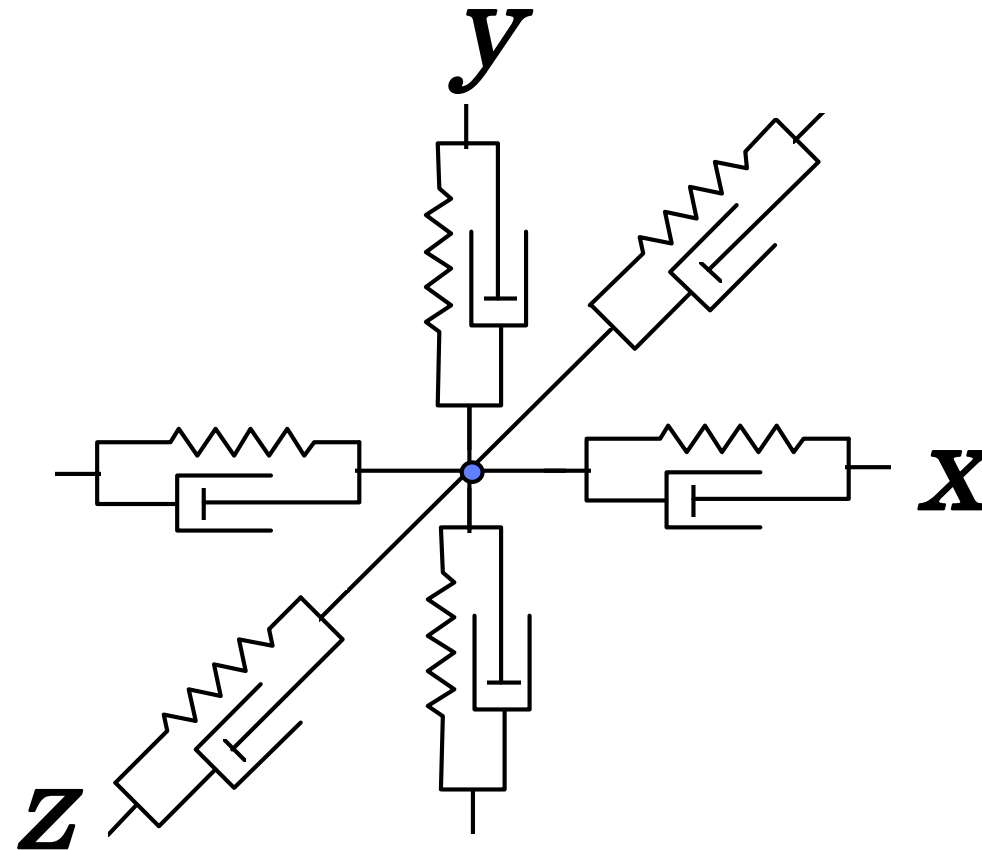
粘弾性体モデルで表現した仮想物体の構築と加工

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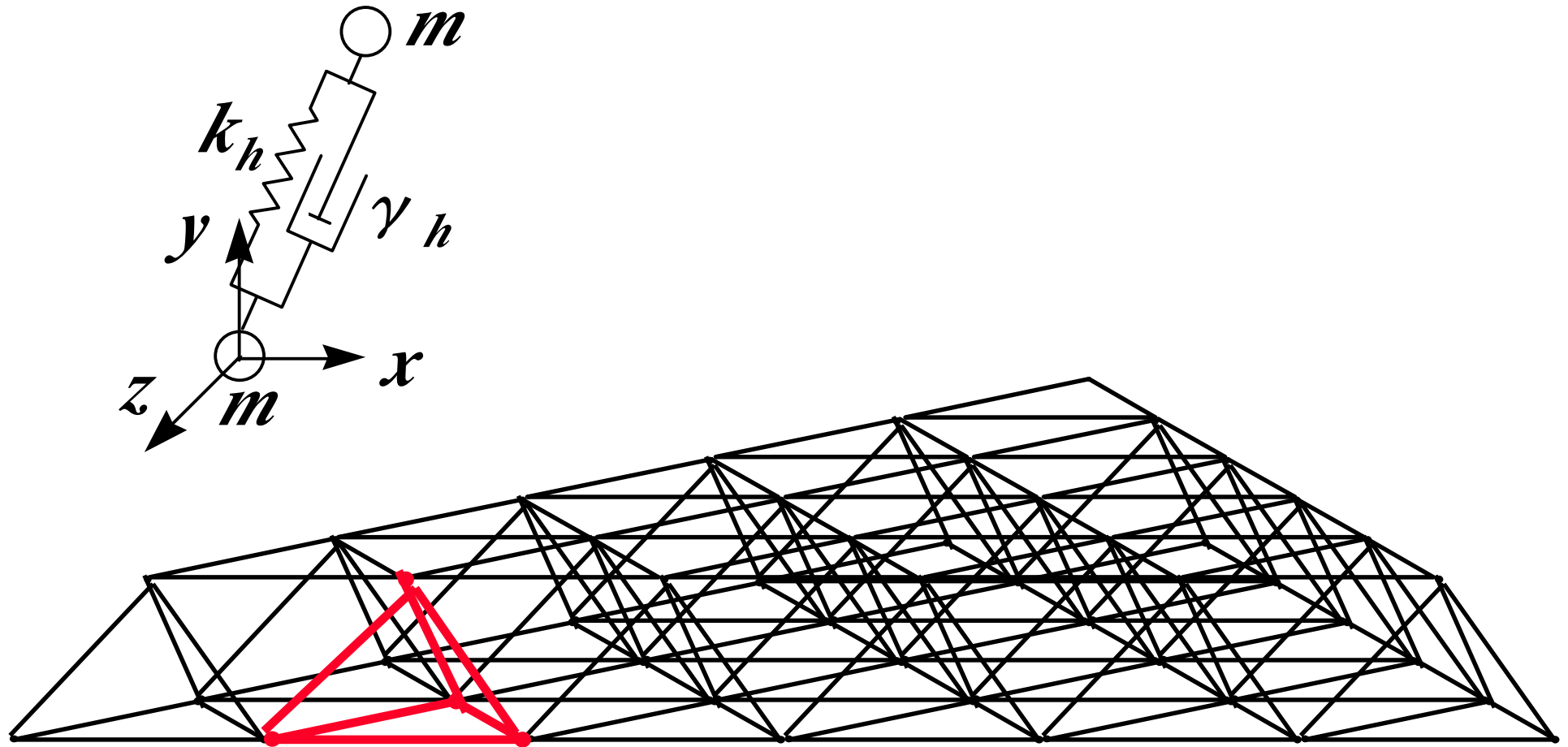
(東京医科歯科大学)

目 的

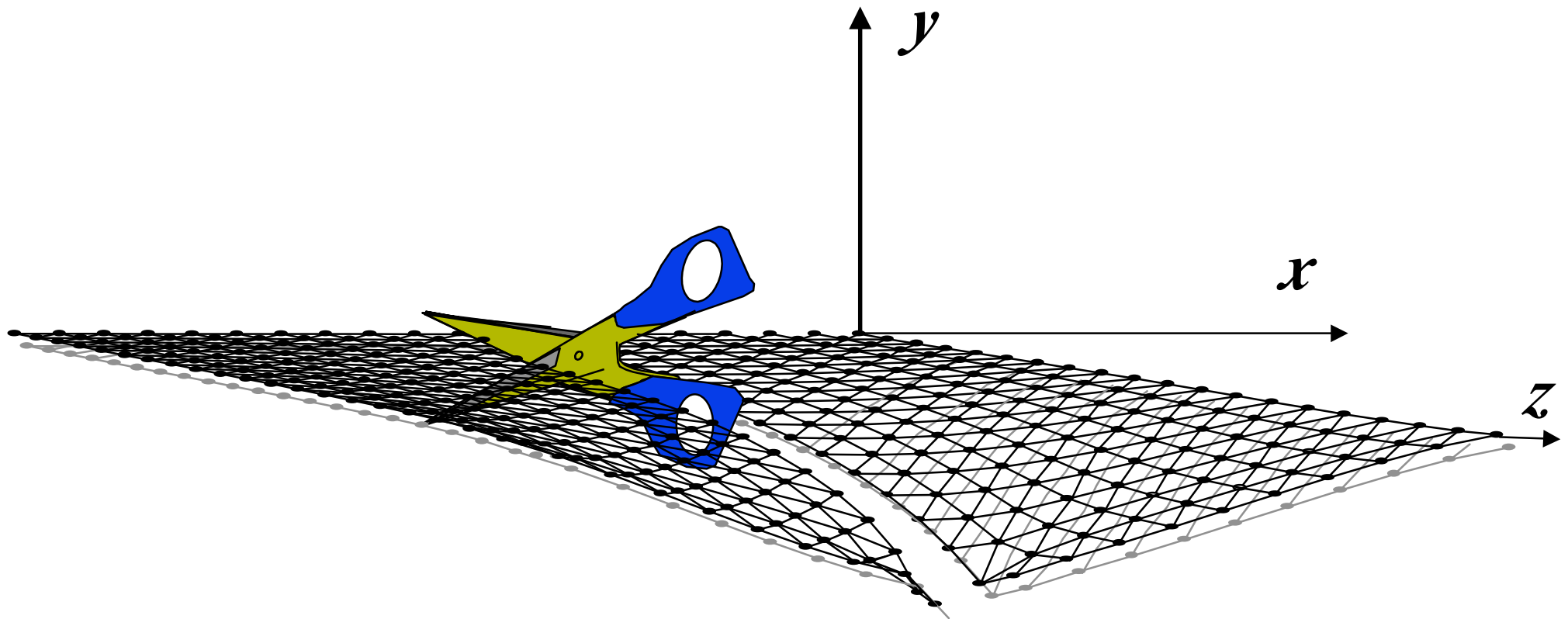
- ・ 粘弾性体モデルを用いた三次元仮想物体の構築
- ・ 粘弾性体モデルに与えられた物性値を反映した加工感覚の提供



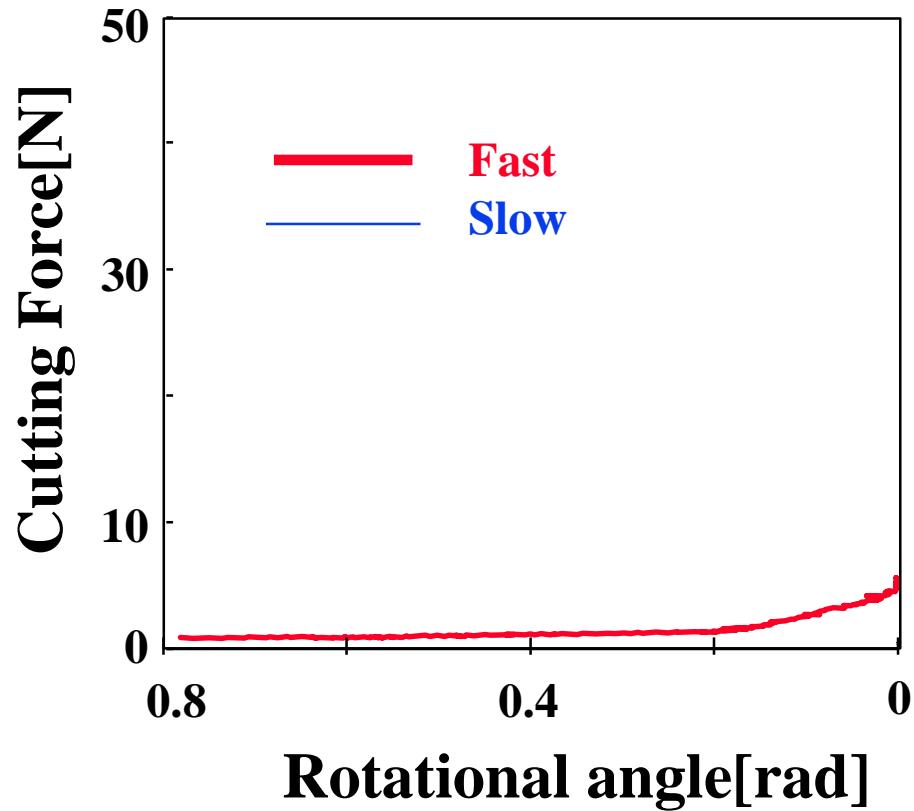
Unit viscous-elastic model



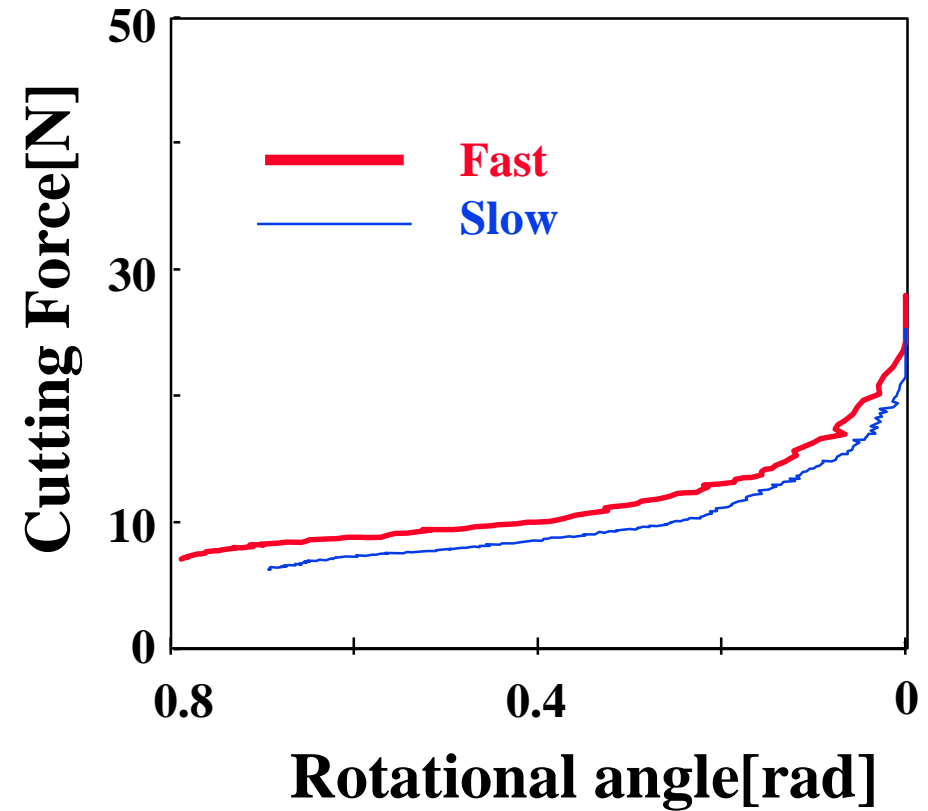
3D basic model of two-layer virtual object to be cut



Appearance of the bending on the cutting of the virtual object caused by gravity

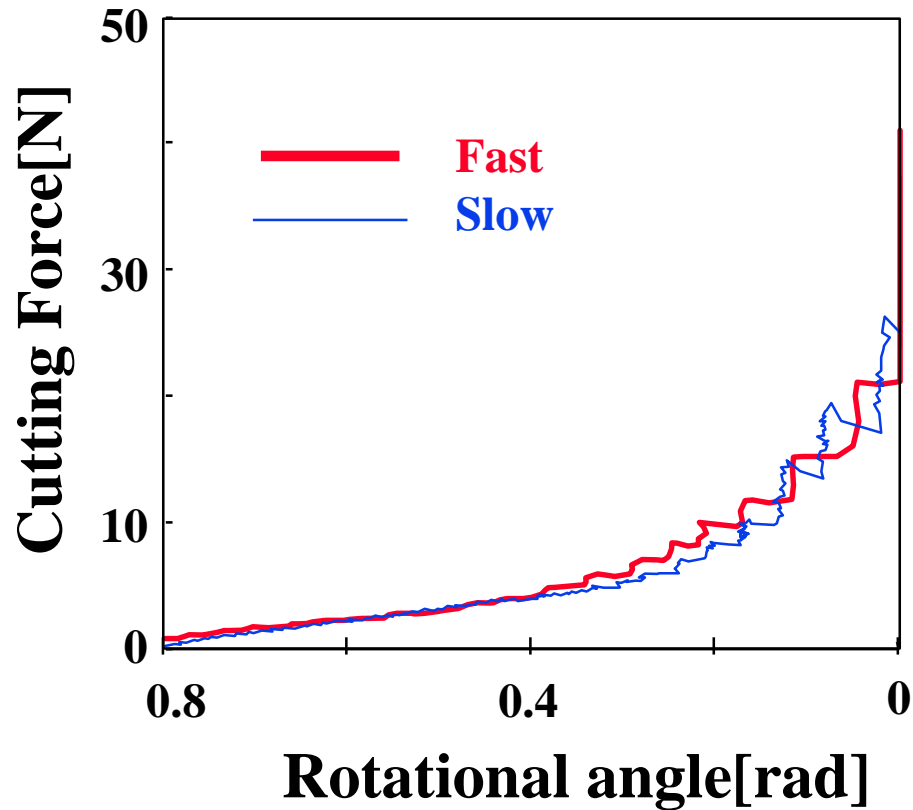


Nothing

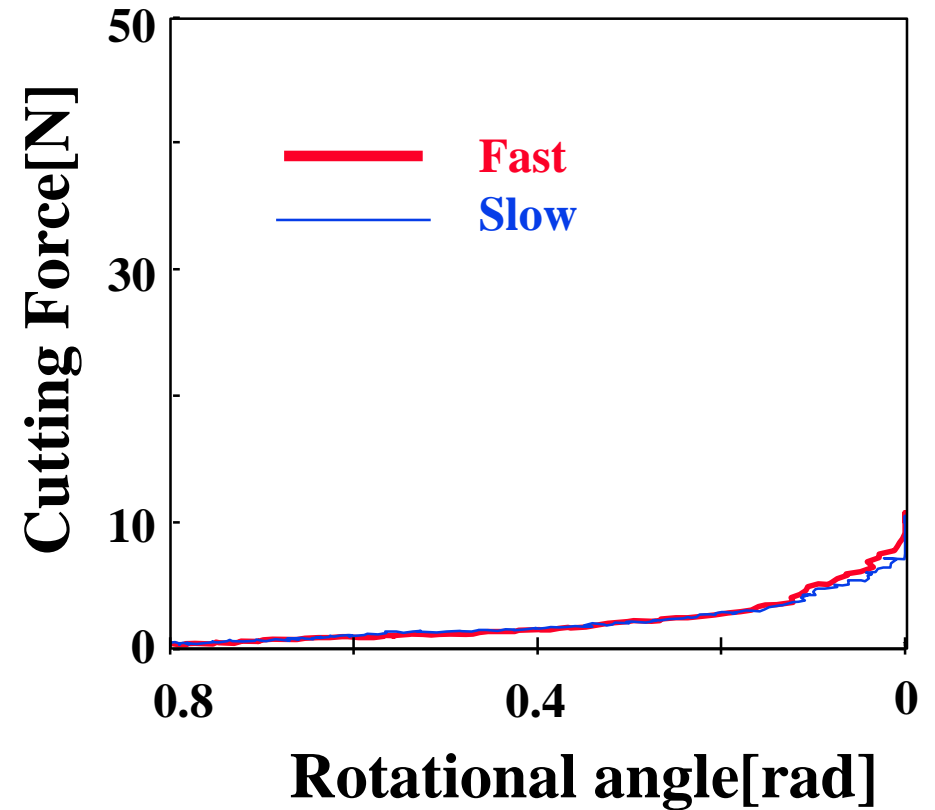


Rubber

Resistance force and Rotational angle

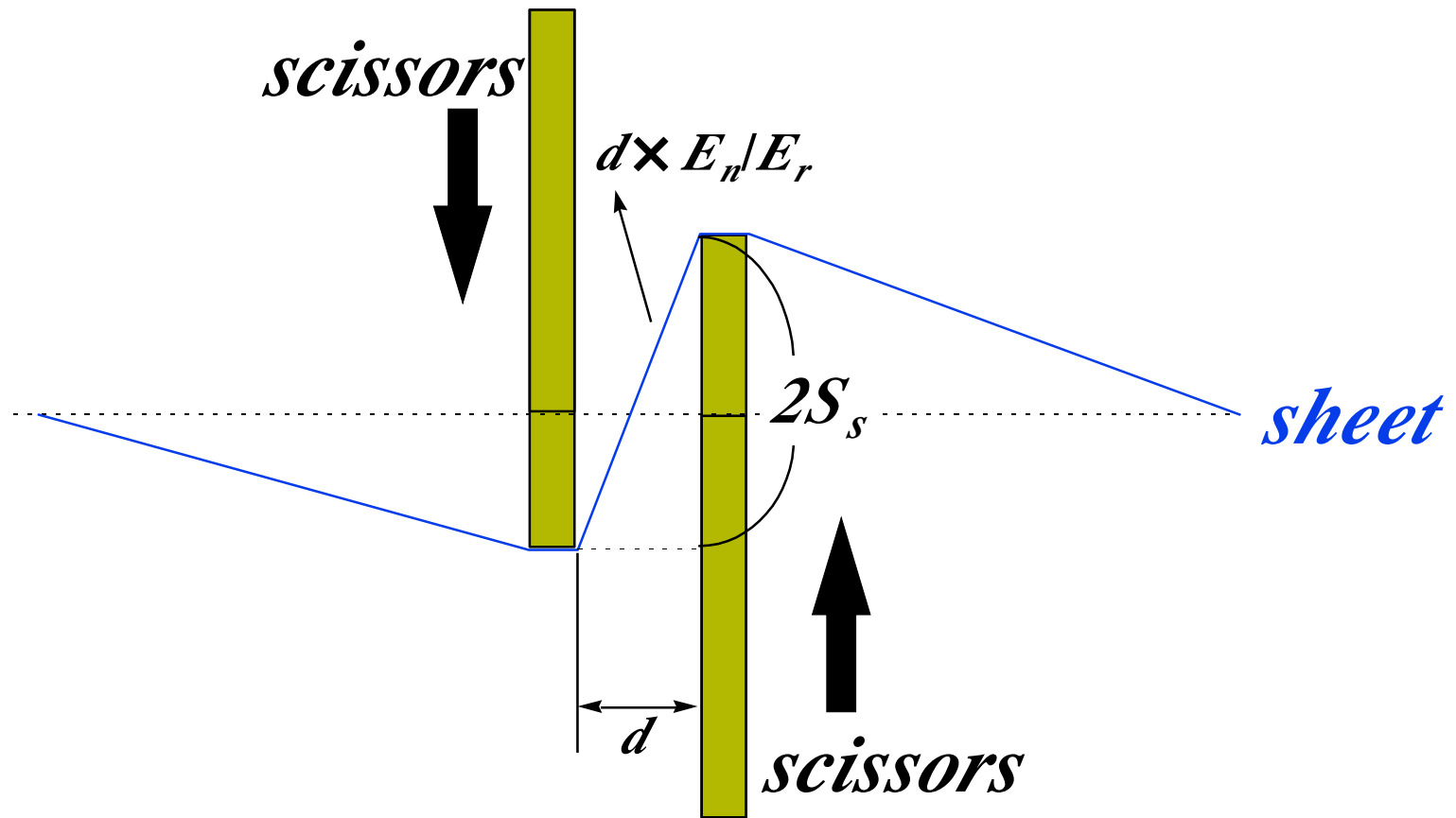


Vinyl chloride

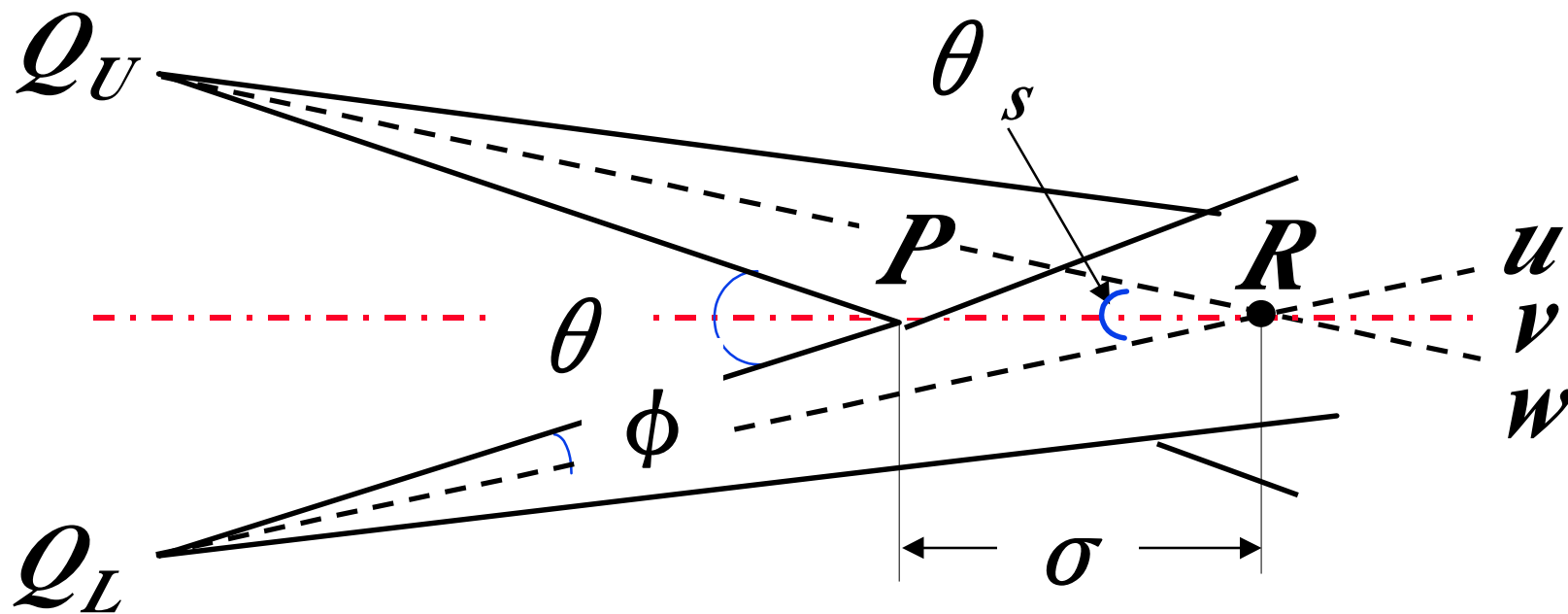


Paper

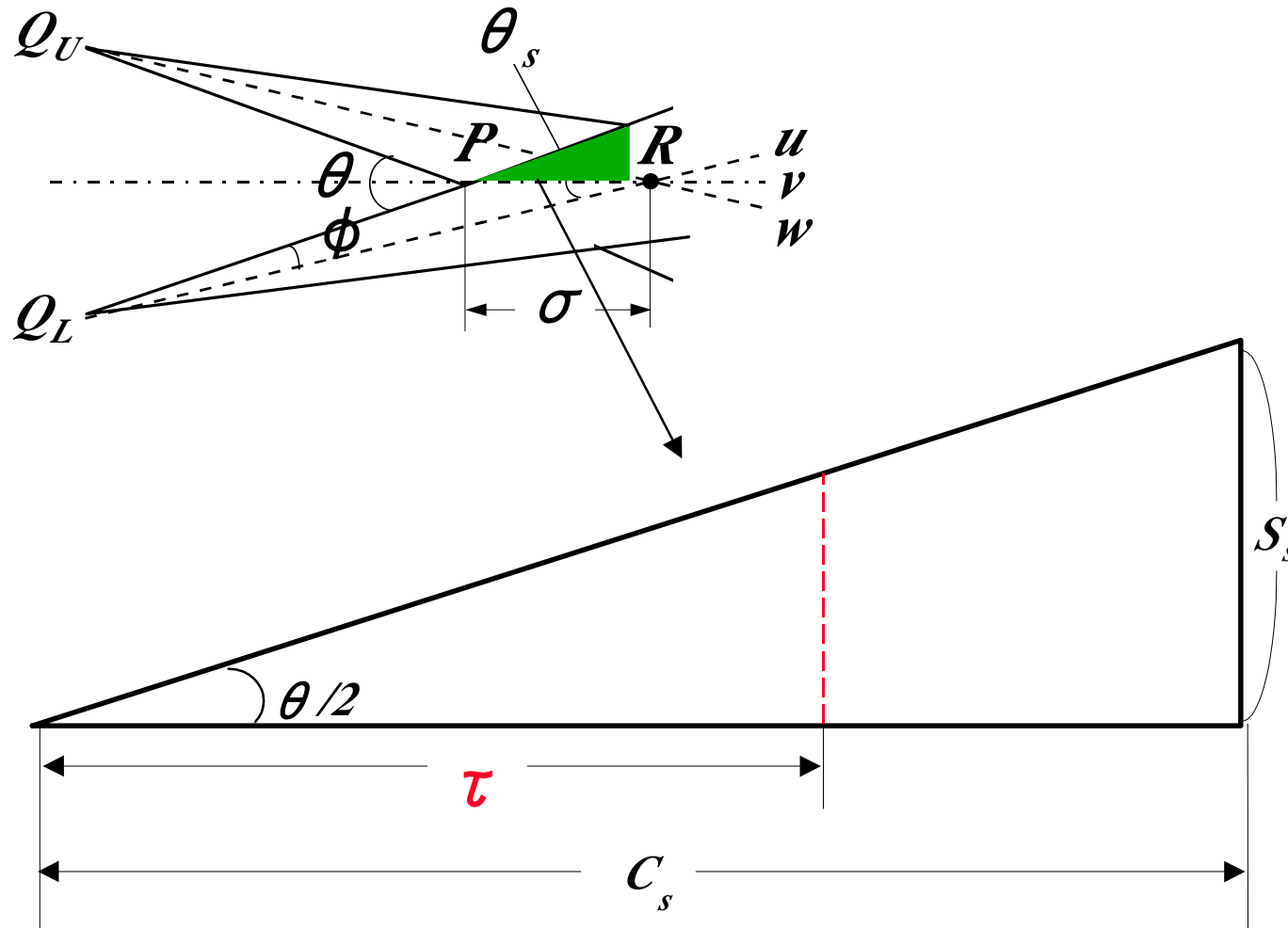
Resistance force and Rotational angle



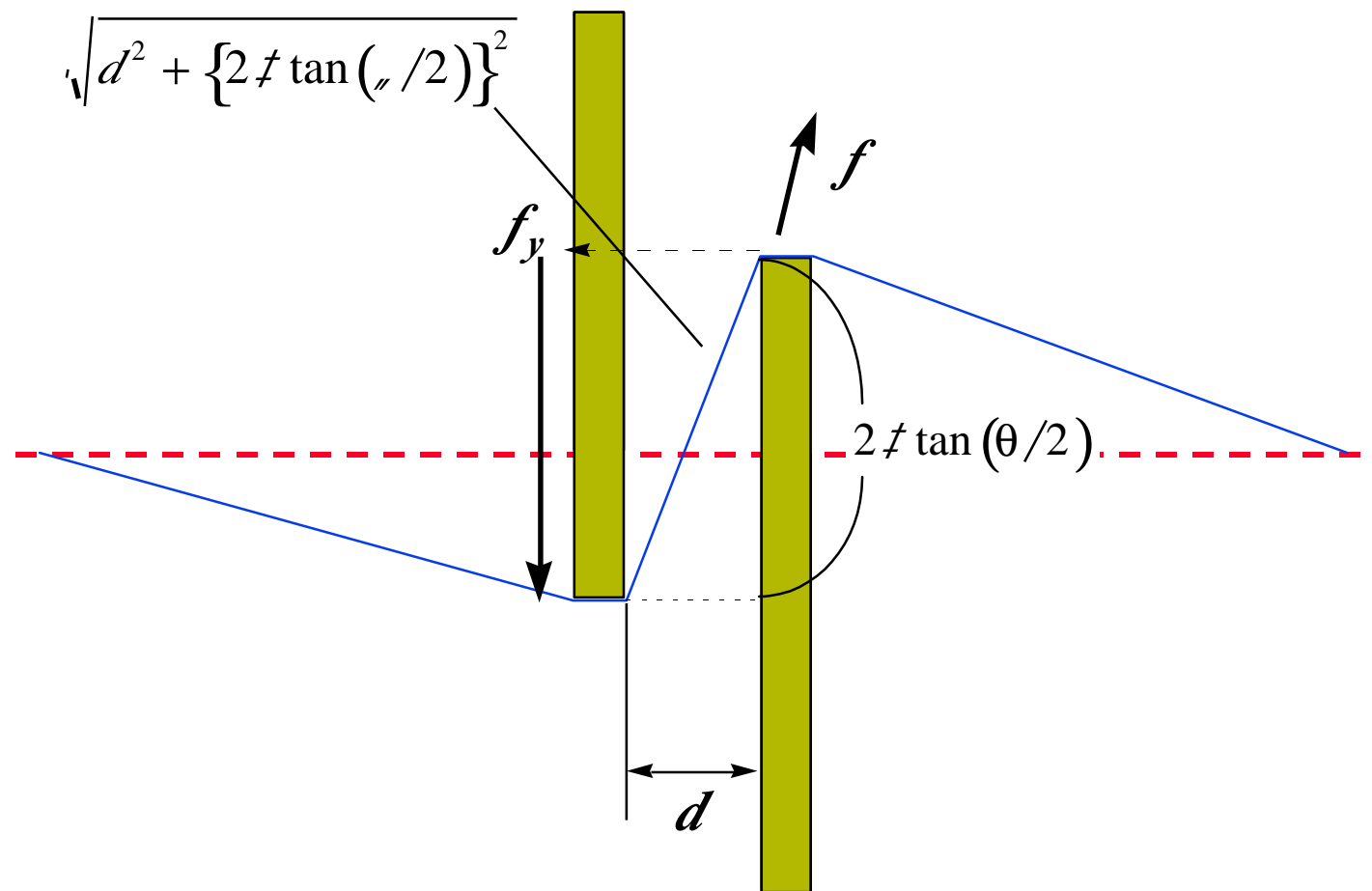
Distortion of material on its cutting by the scissors



Position of the point of action of the scissors



Zooming of the cutting point



Cutting force exerted on the two blades of the scissors

$$R_T = \dagger d (E_s - 1) \left\{ K d (E_s - 1) + 2 \chi \check{S} \dagger \right\} / (2 \mathcal{L} T_s)$$

\dagger : Distance between fulcrum R and point of action P

d : Gap between two blades

E_s : Ratio of stretch to elastic limit of material

K : Apparent coefficient of elasticity

χ : Coefficient of viscosity

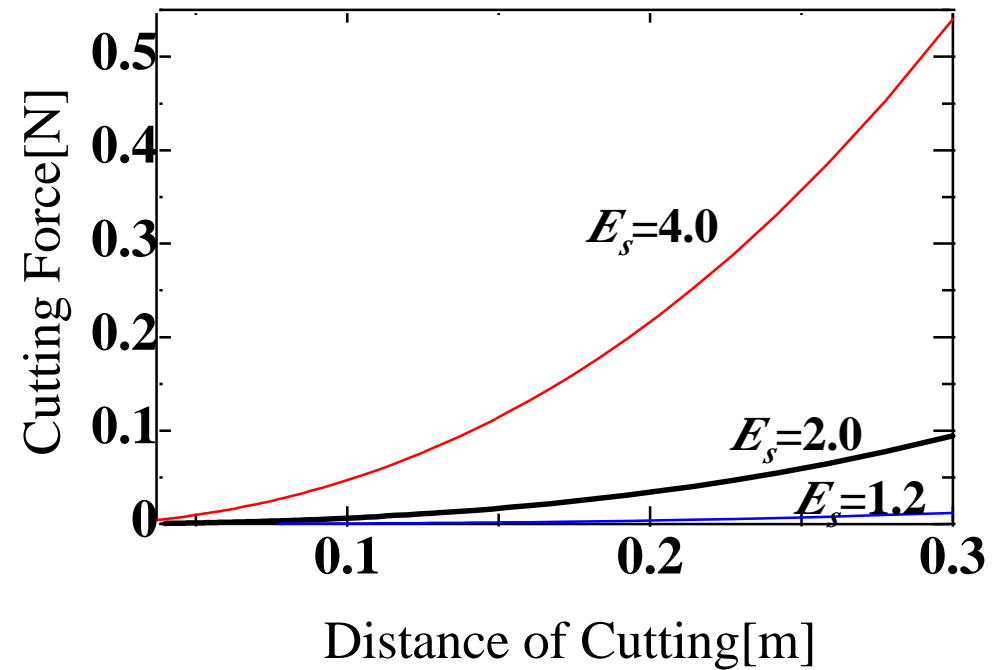
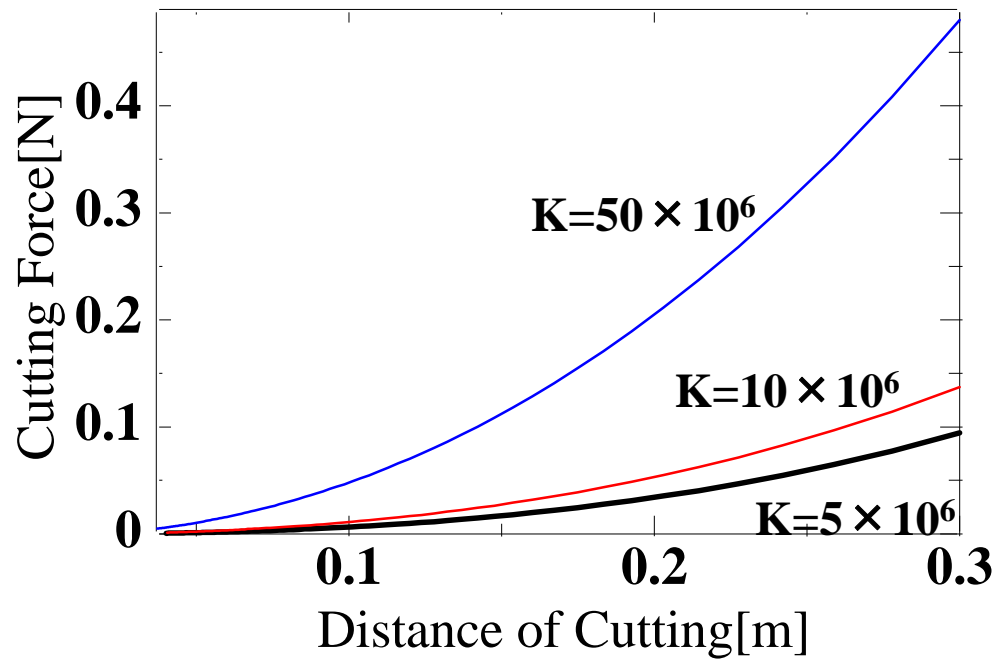
\check{S} : Angular velocity of two blades around fulcrum

\mathcal{L} : Distance from fulcrum to grip

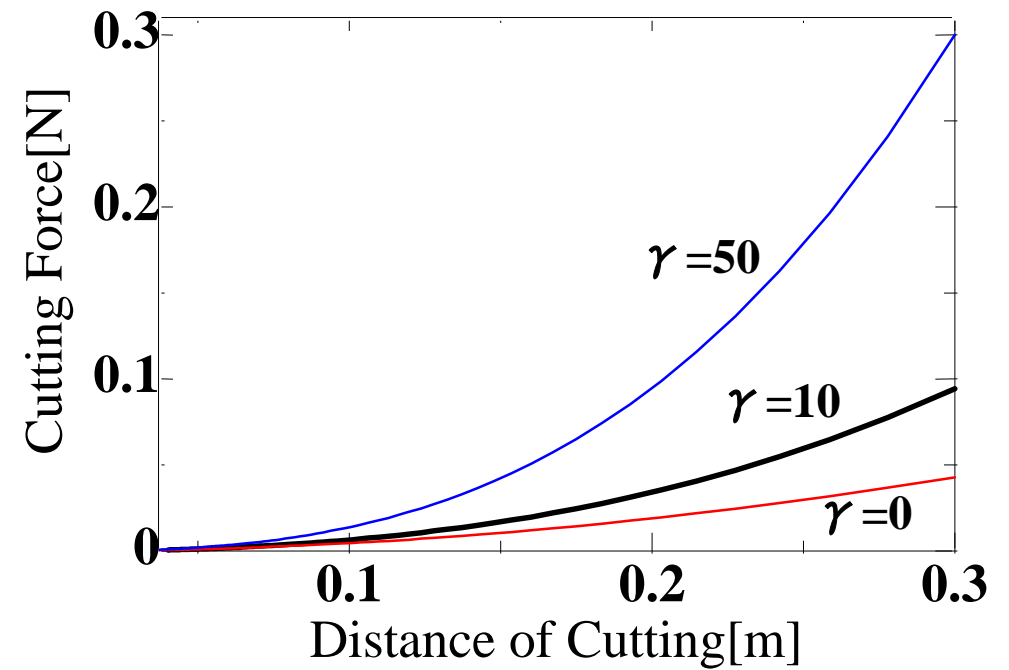
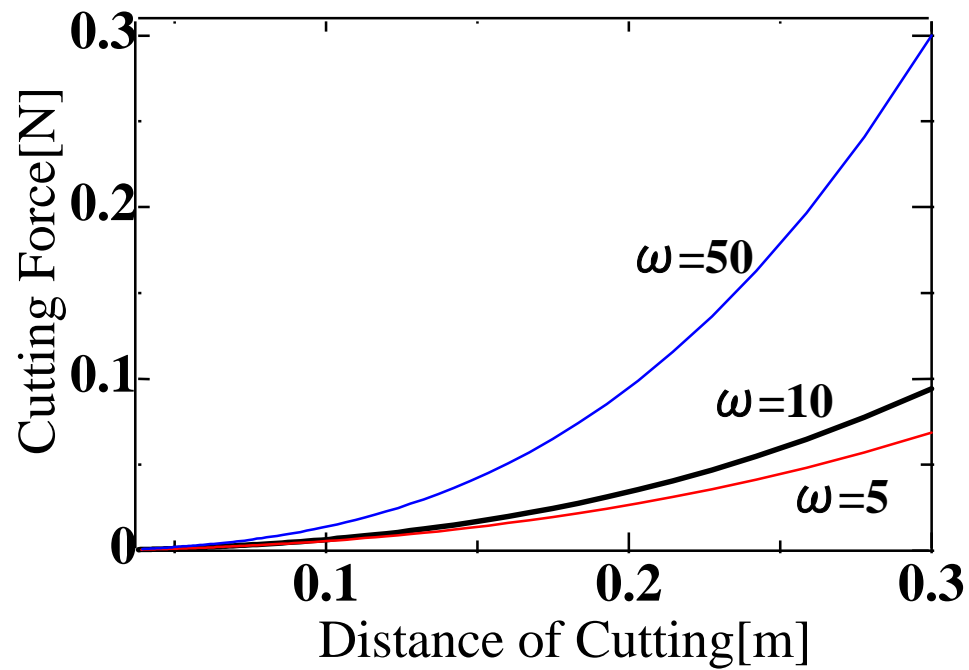
θ : Angle around fulcrum given by two blades

$T_s : 2 \tan(\theta / 2)$

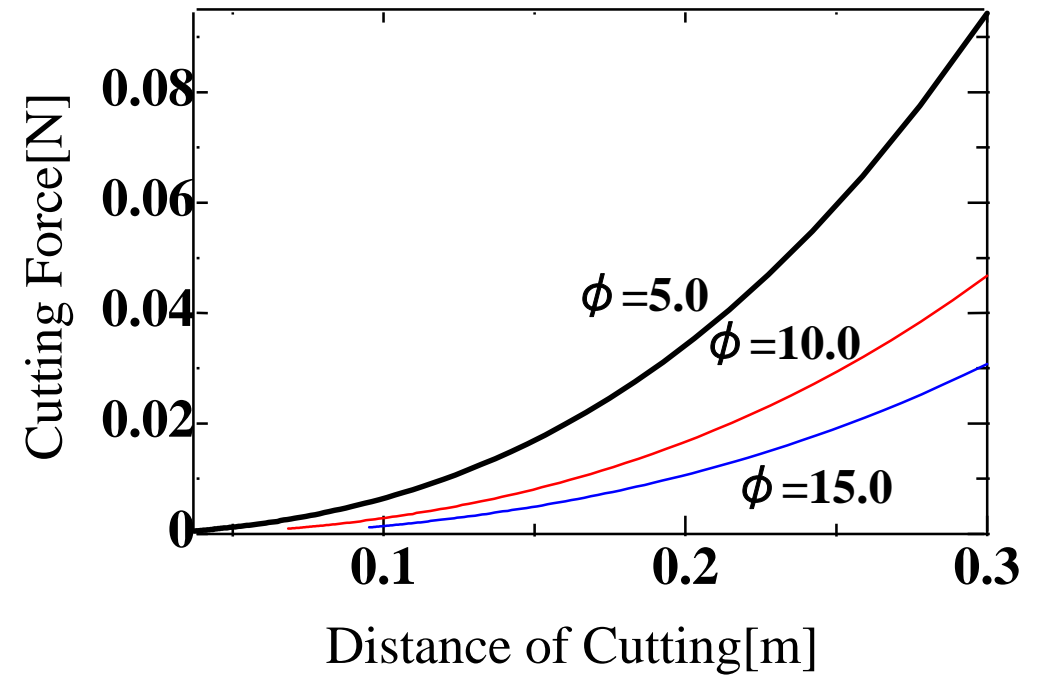
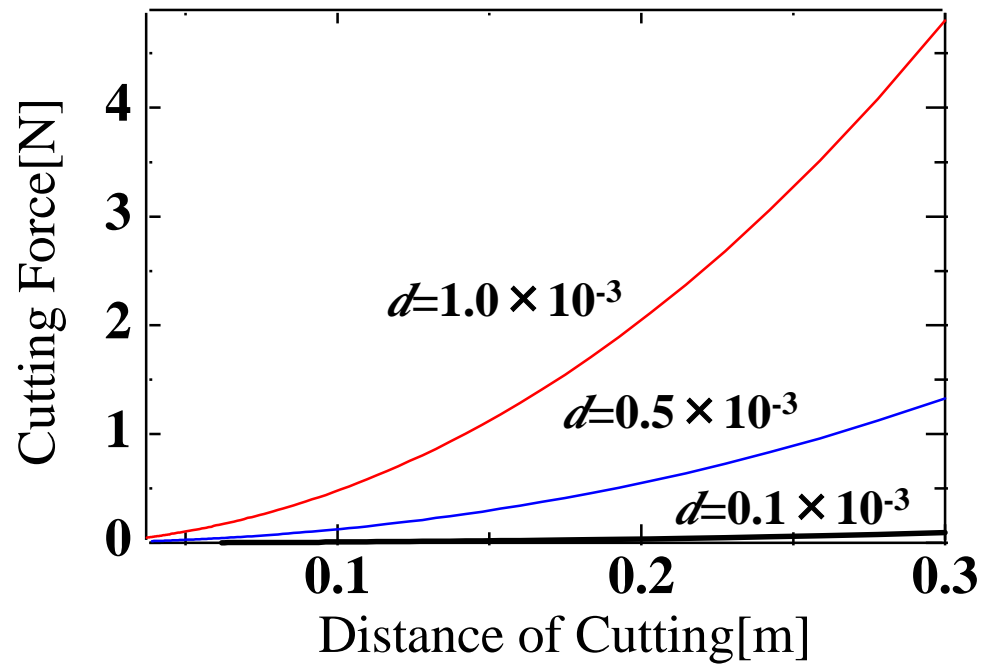
Resistance on the cutting of sheet by scissors



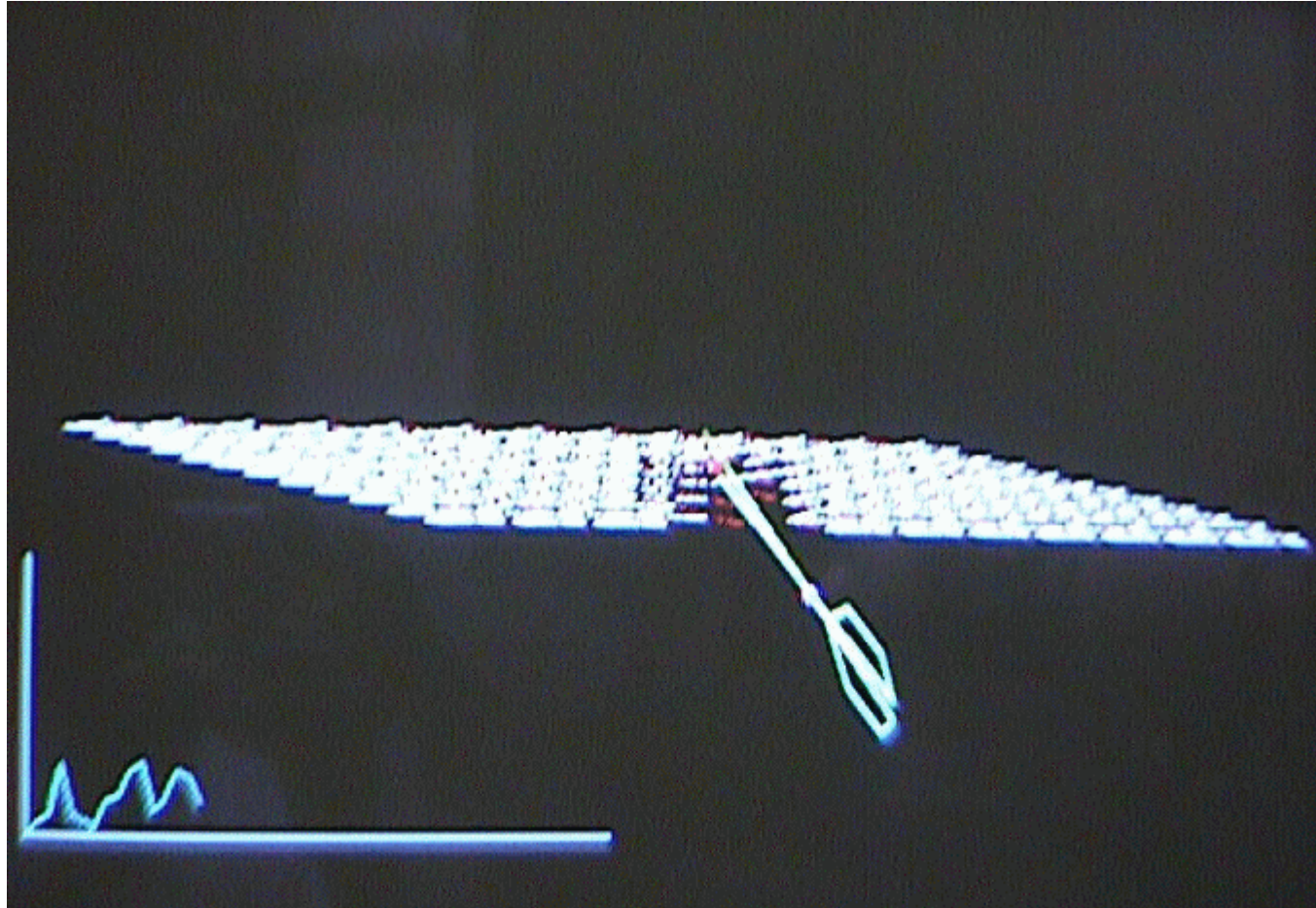
Resistance force and distance of cutting



Resistance force and distance of cutting



Resistance force and distance of cutting



Cutting of virtual object by virtual scissors
with indicator of cutting resistance

まとめ

- 粘弾性体モデルを用いて現実感のある三次元仮想物体を構築し，表現した
- 粘弾性体モデルとハサミに与えられた物性値を用いて実測結果と変わらない加工感覚を提供した

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