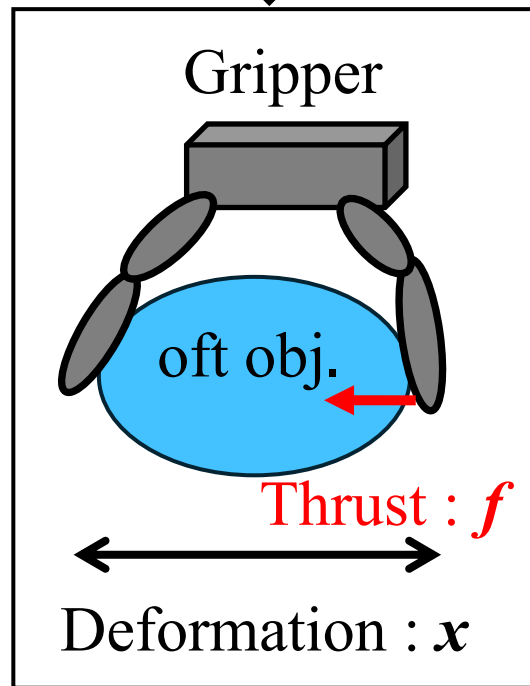
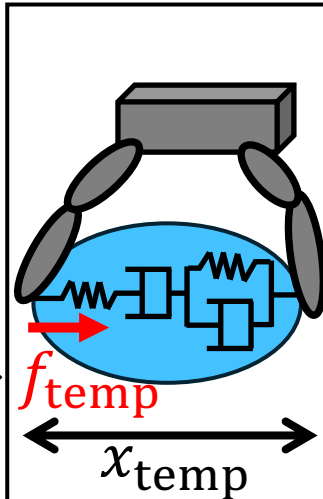


## Initial Conditions

$\mathbf{x}_0 \leftarrow \text{quintic func. } (x_{\text{limit}})$   
 $\mathbf{f}_0 \leftarrow \text{contact soft obj. } (\mathbf{x}_0)$



## Orthogonal Matrix Generation ; $\mathbf{Q}$



$\mathbf{x}_{\text{temp}} \leftarrow \text{quintic func. } ((x_{\text{limit}} = 1))$   
 $\mathbf{f}_{\text{temp}} \leftarrow (\mathbf{p}, \mathbf{x}_{\text{temp}})$   
 $\mathbf{M}_{\text{temp}} \leftarrow (\mathbf{p} \text{ to } \mathbf{x}_{\text{temp}}, \mathbf{f}_{\text{temp}})$   
 $\mathbf{Q} \leftarrow \text{qr decomposition}(\mathbf{M}_{\text{temp}})$

## Boundary Conditions

$\mathbf{x}(0) = 0$   
 $\dot{\mathbf{x}}(0) = 0$   
 $\ddot{\mathbf{x}}(0) = 0$   
 $\mathbf{x}(\text{end}) = x_{\text{limit}}$   
 $\dot{\mathbf{x}}(\text{end}) = 0$

**noise**  
 $\mathbf{p}$

## Diagonal Matrix Generation ; $\mathbf{R}$

$O(\gamma) \gg \frac{O(\text{noise})}{O(\mathbf{p})} \quad \mathbf{R} \leftarrow \sqrt{\gamma} I_{4 \times 4}$

$\mathbf{R}$

$\mathbf{M}_v \leftarrow \mathbf{Q} \mathbf{R}$   
 $\mathbf{x} \leftarrow (\text{Column 1 of } \mathbf{M}_v)$

$\mathbf{x}$