τ Sensed torque

τ_{Ego} Bimanual interaction torque

τ_{Exo} External interaction torque

τ_{Acc} Mass acceleration torque

τ_{Grav} Gravity torque

τ_{Mot} Motor torque

$$\tau = \tau_{Ego} + \tau_{Exo} + \tau_{Acc} + \tau_{Grav} + \tau_{Mot}$$

Forward model: Inverse dynamics
$$\tau = M(q)\ddot{q} + V(q,\dot{q}) + G(q)$$

$$V(q,\dot{q}) = 0 \quad \text{Coriolis and centrifugal}$$

$$\tau_{Acc} = M(q)\ddot{q}$$

$$\tau_{Grav} = G(q)$$

Prediction error
$$\tau_{Ego} + \tau_{Exo} = \tau - \tau_{Acc} - \tau_{Grav} - \tau_{Mot}$$