Object

$$\dot{x} = \theta x + u$$

Reference:

$$\dot{x_M} = -\lambda x_m + \lambda g$$

Error:

$$\varepsilon = x_M - x$$

$$\dot{\varepsilon} = \dot{x_M} - \dot{x}$$
$$= -\lambda x_m + \lambda g - \theta x - u$$

Exponetial Stability:

$$\dot{\varepsilon} = -\lambda \varepsilon$$
$$-\lambda x_m + \lambda g - \theta x - u = -\lambda \varepsilon$$
$$u = -\lambda(\varepsilon - x_M) + \lambda g - \theta x$$
$$u = -\lambda x + \lambda g - \theta x$$

Adaptive:

$$u = -\hat{\theta} x - \lambda x + \lambda g$$

Thay vao Object:

$$\dot{x} = \theta x - \hat{\theta} x - \lambda x + \lambda g$$
$$= \tilde{\theta} x - \lambda x + \lambda g$$

Thay vao Error:

$$\dot{\varepsilon} = \dot{x_M} - \dot{x}$$
$$= -\lambda x_m + \lambda g - \tilde{\theta} x + \lambda x - \lambda g$$
$$= -\lambda \varepsilon - \tilde{\theta} x$$

Lyapunov:

$$V = \frac{1}{2}\varepsilon^2 + \frac{1}{2}\tilde{\theta}^2$$