16 Deadzone Ideas

Let the deadzone be composed of a "dead" section and an S-shaped section. The S-shaped section is designed such that slope at both ends of the S section is continuous.

Let $f(x)$ parameterize the the dead section. Let the width of the dead section be x_1 and the width of the dead and S-shaped section be x_2. Let $S(x) = c_0 + c_1 x + c_2 x^2 + c_3 x^3$. Then,

$$S(x_1) = f(x_1), \tag{197}$$
$$S'(x_1) = f'(x_1), \tag{198}$$
$$S(x_2) = x_2, \tag{199}$$
$$S'(x_2) = 1. \tag{200}$$

The coefficients of $S(x)$ can be obtained by solving

$$Ac = b, \tag{201}$$

where

$$A \triangleq \begin{bmatrix} 1 & x_1 & x_1^2 & x_1^3 \\ 0 & 1 & 2x_1 & 3x_1^2 \\ 1 & x_2 & x_2^2 & x_2^3 \\ 0 & 1 & 2x_2 & 3x_2^2 \end{bmatrix}, \quad b \triangleq \begin{bmatrix} f(x_1) \\ f'(x_1) \\ x_2 \\ 1 \end{bmatrix}. \tag{202}$$

16.1 Zero - S - Linear

Let $f(x) \equiv 0$. Thus, $f'(x) = 0$.

16.2 Linear - S - Linear

Let $f(x) = ax$, where $a \triangleq h/x_1$ and h is the desired height. Thus, $f'(x) = a$.

16.3 Cubic - S - Linear

Let $f(x) = ax^3$, where $a \triangleq h/x_1^3$ and h is the desired height. Thus, $f'(x) = 3ax^2$.

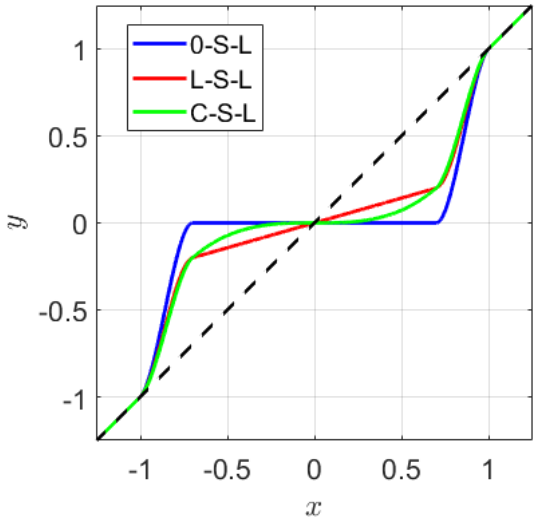

Figure 17: Caption