

Open Loop Simulation Program

Create 2 dimensional Arrays in MATLAB

$$\mathbf{X}k \equiv [\mathbf{X}(0) \quad \mathbf{X}(1) \quad \dots \quad \mathbf{X}(N_s - 1)]_{(n \times N_s)}$$

$$\mathbf{U}k \equiv [\mathbf{U}(0) \quad \mathbf{U}(1) \quad \dots \quad \mathbf{U}(N_s - 1)]_{(m \times N_s)}$$

$$\mathbf{Y}k \equiv [\mathbf{Y}(0) \quad \mathbf{Y}(1) \quad \dots \quad \mathbf{Y}(N_s - 1)]_{(r \times N_s)}$$

$$N_s = \frac{t_f}{T}$$

t_f : Final simulation time

T : sampling interval

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Given these arrays, equation such as

$$\mathbf{X}(k+1) = \mathbf{F}[\mathbf{X}(k), \mathbf{U}(k), \mathbf{w}(k)]$$

$$\mathbf{Y}(k+1) = \mathbf{C}\mathbf{x}(k+1) + \mathbf{v}(k+1)$$

is programmed in the dynamic simulation loop as follows

FOR $k = 1:N-1$

$$\mathbf{X}k(:, k+1) = \text{Runge_Kutta_Solver}[\mathbf{X}k(:, k), \mathbf{U}k(:, k), \mathbf{w}k(:, k)]$$

$$\mathbf{Y}k(:, k+1) = \mathbf{C} * \mathbf{X}k(:, k+1) + \mathbf{v}k(:, k+1)$$

END FOR