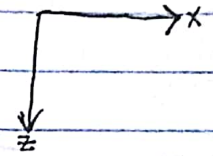
Simplified 2D Problem: Dynamic Programming

Vehicle is well controlled by arbitrary control surface (CS) inputs
No limit on control surface or vehicle α
Constant thrust, don't consider aero forces

State variables (discretized)

$x = X_1^K$ = x coord (abs) @ pseudo time K, meters
$z = X_2^K$ = z coord (abs) @ pseudo time K, meters
$\dot{x} = X_3^K$ = x vel (abs) @ pseudo time K, m/s
$\dot{z} = X_4^K$ = z vel (abs) @ pseudo time K, m/s
$t = X_5^K$ = true time corresponding to pseudo time K



Controls

$u^K = \theta^K$ = missile pitch Euler angle @ pseudo time K, deg
$-90 \le u \le 90$

Dynamics

$$x(k+1) = \begin{bmatrix} X_1(k) + X_3(k)\frac{X_5(N)}{N-1} \\ X_2(k) + X_4(k)\frac{X_5(N)}{N-1} \\ X_3(k) + \frac{m}{T}\cos\theta(k)\frac{X_5(N)}{N-1} \\ X_4(k) + \left(g - \frac{m}{T}\sin\theta(k)\right)\frac{X_5(N)}{N-1} \\ X_5(k) + \frac{X_5(N)}{N-1} \end{bmatrix} \qquad K = 0, 1, 2, \ldots, N$$

$X_5(N) = t_f$

$\frac{1}{N-1} = \frac{\tau_f - \tau_0}{N-1} = \Delta\tau$

Discretize

$X_{1,min} \le X_1(K) \le X_{1,max}$, $K = 0, 1, \ldots, N$ on m_1 points
⋮
$X_{5,min} \le X_5(k) \le X_{5,max}$, $K = 0, 1, \ldots, N$ on m_5 points

$\theta_{min} \le \theta(k) \le \theta_{max}$, $K = 0, 1, \ldots, N-1$ on m_6 points