vcar + ivcar2

$$\boxed{x(k+1) = A_d\, x(k) + B_d\, v(k)}$$

$$2\times 3 \left\{ \begin{bmatrix} V_{c+1} \\ I_{f+1} \end{bmatrix} = \underbrace{\begin{bmatrix} ad_1 & ad_2 \\ ad_3 & ad_4 \end{bmatrix}}_{2\times 2} \underbrace{\begin{bmatrix} V_c \\ I_f \end{bmatrix}}_{2\times 3} + \begin{bmatrix} bd_1 & bd_2 \\ bd_3 & bd_4 \end{bmatrix} \begin{bmatrix} V_i \\ I_L \end{bmatrix} \right.$$

$$\rightarrow \boxed{\underbrace{V_{c+1}}_{1\times 3} = \underbrace{\begin{bmatrix} ad_1 & ad_2 \end{bmatrix}}_{A_{dv}\ m_2} \underbrace{\begin{bmatrix} V_c \\ I_f \end{bmatrix}}_{2\times 3} + \underbrace{\begin{bmatrix} bd_1 & bd_2 \end{bmatrix}}_{B_{dV}} \begin{bmatrix} V_i \\ I_L \end{bmatrix}}$$

$$\underbrace{i_{\alpha\beta}(t) = \frac{2}{3}\begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix}}_{\alpha_M\ 2\times 3} \begin{bmatrix} i_a(t) \\ i_b(t) \\ i_c(t) \end{bmatrix}$$

$$\Rightarrow \underbrace{\begin{bmatrix} V_{c\alpha}^{k+1} \\ V_{c\beta}^{k+1} \end{bmatrix}}_{2\times 1} = \alpha_M \cdot V_{c+1}^{T}$$

$$\begin{bmatrix} V_{c\alpha} \\ V_{c\beta} \end{bmatrix} = \underbrace{\alpha_M}_{2\times 3} \cdot \left(\underbrace{A_{dV}}_{1\times 2} \underbrace{\begin{bmatrix} V_c \\ I_f \end{bmatrix}}_{2\times 3} \right)^T + \alpha_M \cdot \left(\underbrace{B_{dV}}_{3\times 2} \begin{bmatrix} V_i \\ I_L \end{bmatrix} \right)^T$$

$$\boxed{\underbrace{\begin{bmatrix} V_{c\alpha} \\ V_{c\beta} \end{bmatrix}}_{\substack{V_{c\alpha\beta} \\ Y}}^{2\times 1} = \underbrace{\alpha_M}_{2\times 3} \cdot \underbrace{\underbrace{\begin{bmatrix} V_c \\ I_f \end{bmatrix}^T}_{3\times 2} \underbrace{A_{dv}^{T}}_{2\times 1}}_{\tilde{X}} + \alpha_M \cdot \underbrace{\underbrace{\begin{bmatrix} V_i \\ I_L \end{bmatrix}^T}_{3\times 2} \underbrace{B_{dv}^{T}}_{2\times 1}}_{\tilde{U}\ 3\times 1}}$$

$$\begin{bmatrix} V_{c\alpha} \\ V_{c\beta} \end{bmatrix} = \alpha_M \cdot \tilde{X} + \alpha_M \cdot \tilde{U}$$

3×2 2×1

$$\underbrace{M}_{3\times 3} = \underbrace{\alpha_M^T}_{3\times 2} \underbrace{\alpha_M}_{2\times 3}, \quad f = \alpha_M^T \alpha_M \tilde{X}^T - \alpha_M^T V_{ref} \rightarrow 3\times 1$$

$$v_p = \begin{bmatrix} 1200 & 1200 & 1200 \\ 500 & 500 & 500 \end{bmatrix}' \cdot B_{dV}'$$

$$\tilde{U}\left(B_{dv}^T\right)^{-1} = U$$