

矩陣函數與狀態方程式

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Matrix function:

Continuum mechanics:

$$U = \sqrt{C}$$

Dynamics and control:

$$\mathbf{x}(t) = e^{At} \mathbf{x}_0 + \int_0^t e^{A(t-\tau)} \mathbf{f}(\tau) d\tau$$

Rigid body dynamics:

$$A = -A^T$$

State equation:

$$\dot{\mathbf{x}} = A\mathbf{x}$$

$$\frac{dx_1(t)}{dt} = a_{11}x_1 + \cdots + a_{1n}x_n$$

$$\frac{dx_2(t)}{dt} = a_{21}x_1 + \cdots + a_{2n}x_n$$

$$\frac{dx_3(t)}{dt} = a_{31}x_1 + \cdots + a_{3n}x_n$$

$$\cdots = \cdots + \cdots + \cdots$$

$$\frac{dx_n(t)}{dt} = a_{n1}x_1 + \cdots + a_{nn}x_n$$

If A is a constant matrix, the solution is

$$\mathbf{x}(t) = e^{At} \mathbf{x}_0$$

If A is a function of time, the solution is

$$F(W_1)F(W_2)F(W_3) \cdots F(W_n) \cdots$$

Example 1: Euler-Cauchy equation

Example 2: Bessel equation

Example 3: Legendre equation

Change to third order ODE, have a 3 by 3 matrix with variable A .

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