변수변환

① $\frac{du}{dt} = Au$ $\qquad u = Mv$

$$\frac{M dv}{dt} = AMv$$

$$\frac{dv}{dt} = M^{-1}AMv$$

② $u_{n+1} = Au_n$

$$Mv_{n+1} = AMv_n$$

$$v_{n+1} = M^{-1}AMv_n$$

$$A^k = M J^k M^{-1}$$

$$(J_i)^k = \begin{bmatrix} \lambda & 1 & 0 \\ 0 & \lambda & 1 \\ 0 & 0 & \lambda \end{bmatrix}^k = \begin{bmatrix} \lambda^k & k\lambda^{k-1} & \frac{1}{2}k(k-1)\lambda^{k-2} \\ 0 & \lambda^k & k\lambda^{k-1} \\ 0 & 0 & \lambda^k \end{bmatrix}$$

$$e^{J_i t} = \begin{bmatrix} e^{\lambda t} & te^{\lambda t} & \frac{1}{2}t^2 e^{\lambda t} \\ 0 & e^{\lambda t} & te^{\lambda t} \\ 0 & 0 & e^{\lambda t} \end{bmatrix}$$

$$u_{k+1} = A u_k \longrightarrow u_k = A^k u_0$$

$$= M J^k M^{-1} u_0$$

$$\frac{du}{dt} = Au \longrightarrow u(t) = e^{At} u(0)$$

$$= M e^{Jt} u(0)$$