

??

$$M\ddot{U}(t)+C\dot{U}(t)+KU(t)=F(t)$$

$$(1) \quad \begin{matrix} \beta \\ \theta \end{matrix}$$

+

$$\begin{aligned} & t+\Delta t U = \\ & \dot{U} + \frac{\Delta t^2}{2} t+\Delta t \ddot{U} \\ & t+\Delta t \dot{U} = \\ & \frac{3}{2\Delta t} t+\Delta t U - \\ & \frac{\Delta t}{2} \dot{U} + \\ & \frac{1}{2\Delta t} t-\Delta t U \\ & t+\Delta t ?? \end{aligned}$$

$$(2) \quad M^{t+\Delta t}\ddot{U}+C^{t+\Delta t}\dot{U}+K^{t+\Delta t}U = {}^{t+\Delta t}F$$

$$\Delta t \dot{U} = \frac{3}{2\Delta t}(\Delta t U - {}^0U) - \frac{1}{2} {}^0\dot{U} + \frac{\Delta t}{4} {}^0\ddot{U}$$

$$(3) \quad \begin{matrix} \beta \\ \gamma \end{matrix}$$

$$\begin{aligned} & 1/2? \\ & t+\Delta t U = \\ & \dot{U} + \\ & \dot{U} \Delta t + \\ & \frac{\Delta t^2}{2} t+\Delta t \ddot{U} \\ & t+\Delta t \dot{U} = \\ & \dot{U} + \\ & \frac{\Delta t}{2} (t\ddot{U} + \\ & t+\Delta t \ddot{U}) \end{aligned}$$

??

$$\gamma = \beta =$$

1/2?

?

$$\Delta t^{t+\Delta t} \ddot{U}$$

$$t+\Delta t \ddot{U} = \ddot{U} + \Delta t \dot{U}^{(3)}$$

$$(4) \quad \ddot{U} = \frac{{}^{t+\Delta t}U - 2{}^tU + {}^{t-\Delta t}U}{\Delta t^2}, \dot{U}^{(3)} = \frac{{}^{t+\Delta t}\dot{U} - 2{}^t\dot{U} + {}^{t-\Delta t}\dot{U}}{\Delta t^2}$$

$$(5) \quad \begin{matrix} t+\Delta t \ddot{U} \\ \end{matrix}$$

$$t+\Delta t \ddot{U} = \frac{{}^{t+\Delta t}U - 2{}^tU + {}^{t-\Delta t}U}{\Delta t^2} + \frac{{}^{t+\Delta t}\dot{U} - 2{}^t\dot{U} + {}^{t-\Delta t}\dot{U}}{\Delta t}$$

$$(6) \quad t+\Delta t \dot{U}$$

$$t+\Delta t \dot{U} = \frac{1}{2\Delta t} (3{}^{t+\Delta t}U - 4{}^tU + {}^{t-\Delta t}U)$$

$$(7) \quad \begin{matrix} t+\Delta t \\ \beta \end{matrix}$$

?

?

$$\begin{aligned} & ?t\dot{U}, \dot{U}, \ddot{U}t + \\ & \Delta t^{t+\Delta t} \dot{U}, {}^{t+\Delta t} \ddot{U}, {}^{t+\Delta t} \ddot{U} \Delta t \gamma \Delta t, (1- \\ & \gamma) \Delta t \end{aligned}$$

$$\gamma \Delta t ?$$

$$t+\gamma \Delta t \dot{U} = \dot{U} + \frac{\ddot{U} + {}^{t+\gamma \Delta t} \ddot{U}}{2} \gamma \Delta t$$

$$t+\gamma \Delta t U = U + \frac{\dot{U} + {}^{t+\gamma \Delta t} \dot{U}}{2} \gamma \Delta t$$

$$\Delta t$$