11 April 91

Higher Order Predictor Scheme

Let

$$\underbrace{\underline{d}}_{\text{all displacements}} = \underbrace{\underline{\bar{d}}(\lambda)}_{\text{user-spec. init. displ.}} + \underbrace{\underline{B}}_{\text{boolean operator}} \; \underbrace{\underline{u}}_{\text{unknown displ. contrib.}}$$

$$\underline{z} = \begin{bmatrix} \underline{u} \\ \lambda \end{bmatrix} \qquad \underline{u} = \underbrace{\underline{B}'}_{\text{inverse boolean operator (BBEV)}} \left(\underline{d} - \underline{\bar{d}}(\lambda) \right) \qquad (2)$$

At end of loadstep we have $\underline{d}$, $\underline{d}_0$, $\dot{\underline{z}}$.

We wish to estimate

$$\underline{z}(\Delta\eta) = \underline{z} + \Delta\eta \, \dot{\underline{z}} + \tfrac{1}{2}(\Delta\eta)^2 \, \ddot{\underline{z}} \qquad (3)$$

Evaluation of Backward Increments.

$$\Delta\underline{z} \equiv \underline{z}_0 - \underline{z} = \begin{bmatrix} \lambda_0 - \lambda \\ \underline{u}_0 - \underline{u} \end{bmatrix} \equiv \begin{bmatrix} \Delta\lambda \\ \Delta\underline{u} \end{bmatrix} \qquad (4)$$

$$\Delta\underline{u} = \underline{u}_0 - \underline{u} = \underline{B}' \left[\underline{d}_0 - \underline{d} - \underline{\bar{d}}(\lambda_0) + \underline{\bar{d}}(\lambda) \right] \qquad (5)$$

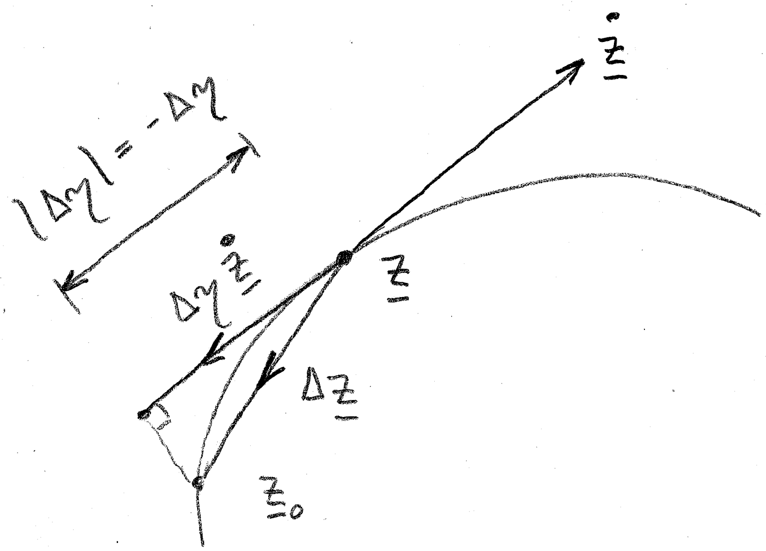
$$\Delta\eta \equiv \Delta\underline{z} \cdot \dot{\underline{z}} \qquad \text{(negative)} \qquad (6)$$

For this $\Delta\eta$:

$$\underline{z}(\Delta\eta) = \underline{z}_0 = \underline{z} + \Delta\eta \, \dot{\underline{z}} + \tfrac{1}{2}\Delta\eta^2 \, \ddot{\underline{z}} \qquad (7)$$

$$\Rightarrow \quad \frac{1}{2}\Delta\eta^2\,\ddot{\underline{z}} = \underline{z}_0 - \underline{z} - \Delta\eta\,\dot{\underline{z}}$$
$$= \Delta\underline{z} - \Delta\eta\,\dot{\underline{z}} .$$

$$\boxed{\ddot{\underline{z}} = \frac{2}{\Delta\eta^2}\left(\Delta\underline{z} - \Delta\eta\,\dot{\underline{z}}\right)} \qquad (8)$$



Procedure

1) get $\Delta\underline{u}$ from (5); (store in BB)

   Also form $\Delta\lambda$ from (4). (store in DTIME).

2) get $\Delta\eta$ from (6). (Call this DETAB)

3) get $\ddot{\underline{z}}$ from (8). (store in BB-L)

4) Use (3) to calculate predictor value for next step.