strain rate averaging

DT = 0 (running average)

$$\dot{\varepsilon}_n^{avg} = \frac{1}{11}\left[\sum_{i=1}^{10} \dot{\varepsilon}_{n-i}^{avg} + \dot{\varepsilon}_n\right]$$

with $\dot{\varepsilon}_n = \frac{\varepsilon_n - \varepsilon_{n-1}}{\Delta t}$

DT < 0 (average of last 11 steps)

$$\dot{\varepsilon}_n^{avg} = \frac{1}{11}\left[\sum_{i=1}^{11} \dot{\varepsilon}_{n-i+1}\right] \quad \text{with } \dot{\varepsilon}_n = \frac{\varepsilon_n - \varepsilon_{n-1}}{\Delta t}$$

DT > 0

$$\dot{\varepsilon}_n^{avg} = \frac{\varepsilon_n - \varepsilon_1}{DT}$$

ε_1 equals the scaled strain at time: $n - DT$

10 strain values used to compute $\varepsilon_1 = \varepsilon_{n-DT}$

with: $\varepsilon_i \; (i = 1, \dots, 10)$; $f_{ct} = \frac{\Delta t^{crit}}{0.1 \cdot DT}$

$$\varepsilon_i = \varepsilon_i + (\varepsilon_{i+1} - \varepsilon_i) \cdot f_{ct} \qquad \text{with: } \varepsilon_{11} = \varepsilon_n$$

⇒ 10 strain values (every $0.1 \cdot DT$) are computed by scaling the strain increments between these values, depending on the current timestep size (Δt^{crit}) and the averaging value DT