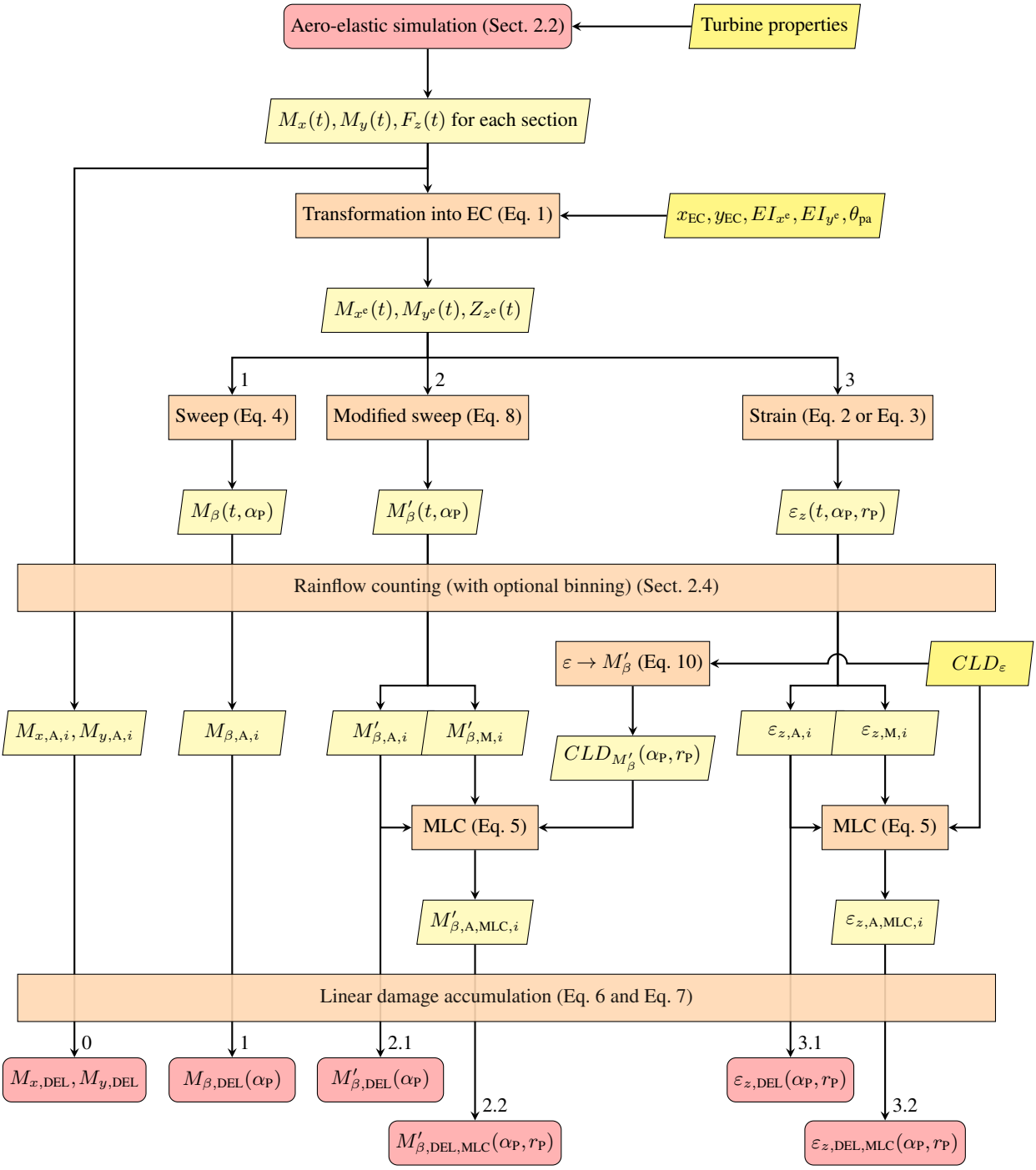
Aero-elastic simulation (Sect. 2.2)
Turbine properties
$M_x(t), M_y(t), F_z(t)$ for each section
Transformation into EC (Eq. 1)
$x_{\mathrm{EC}}, y_{\mathrm{EC}}, EI_{x^{\mathrm{e}}}, EI_{y^{\mathrm{e}}}, \theta_{\mathrm{pa}}$
$M_{x^{\mathrm{e}}}(t), M_{y^{\mathrm{e}}}(t), Z_{z^{\mathrm{e}}}(t)$
1
2
3
Sweep (Eq. 4)
Modified sweep (Eq. 8)
Strain (Eq. 2 or Eq. 3)
$M_\beta(t, \alpha_{\mathrm{P}})$
$M'_\beta(t, \alpha_{\mathrm{P}})$
$\varepsilon_z(t, \alpha_{\mathrm{P}}, r_{\mathrm{P}})$
Rainflow counting (with optional binning) (Sect. 2.4)
$\varepsilon \rightarrow M'_\beta$ (Eq. 10)
CLD_ε
$M_{x,\mathrm{A},i}, M_{y,\mathrm{A},i}$
$M_{\beta,\mathrm{A},i}$
$M'_{\beta,\mathrm{A},i}$
$M'_{\beta,\mathrm{M},i}$
$CLD_{M'_\beta}(\alpha_{\mathrm{P}}, r_{\mathrm{P}})$
$\varepsilon_{z,\mathrm{A},i}$
$\varepsilon_{z,\mathrm{M},i}$
MLC (Eq. 5)
MLC (Eq. 5)
$M'_{\beta,\mathrm{A,MLC},i}$
$\varepsilon_{z,\mathrm{A,MLC},i}$
Linear damage accumulation (Eq. 6 and Eq. 7)
0
1
2.1
3.1
$M_{x,\mathrm{DEL}}, M_{y,\mathrm{DEL}}$
$M_{\beta,\mathrm{DEL}}(\alpha_{\mathrm{P}})$
$M'_{\beta,\mathrm{DEL}}(\alpha_{\mathrm{P}})$
$\varepsilon_{z,\mathrm{DEL}}(\alpha_{\mathrm{P}}, r_{\mathrm{P}})$
2.2
3.2
$M'_{\beta,\mathrm{DEL,MLC}}(\alpha_{\mathrm{P}}, r_{\mathrm{P}})$
$\varepsilon_{z,\mathrm{DEL,MLC}}(\alpha_{\mathrm{P}}, r_{\mathrm{P}})$