Hardening scheme used in CPFEM

The change in CRSS for the i^{th} slip system is calculated as follows:

$$\Delta\tau_c(i) = \sum_{j=1}^{n} H_{i,j} \cdot |\Delta\gamma_j| \tag{1}$$

where $\Delta\gamma_j$ is the slip increment on the j^{th} slip system, n is the number of slip systems and $H_{i,j}$ is a hardening matrix defined as follows:

$$H_{i,j} = L_{i,j} \cdot g(j) \tag{2}$$

where $L_{i,j}$ is the latent hardening matrix defined in the *.fmt* file and g is an array of gradients defined as follows:

$$g(i) = A_3(i) + A_2(i) \cdot \left| 1 - \frac{\tau_c(i)}{A_5(i) \cdot \left(\frac{\sum_{j=1}^{n} |\Delta\gamma_j|}{dt} \right)^{A_6(i)}} \right|^{A_4(i)} \cdot Sgn\left(1 - \frac{\tau_c(i)}{A_5(i) \cdot \left(\frac{\sum_{j=1}^{n} |\Delta\gamma_j|}{dt} \right)^{A_6(i)}} \right) \tag{3}$$

where dt is the time increment (whose value is chosen to be exactly the same as the imposed strain increment - to have a strain rate of 1) and $\tau_c(i)$ is the current CRSS for the i^{th} slip system. $A_2(i), A_3(i), ..., A_6(i)$ are the hardening parameters for the i^{th} slip system in the order they were given in the *.fmt* file.