Appendix F

Convergence and stability conditions for 3 – D model

In this Appendix e summarize the conditions that have to be satisfied in order to have a proper resolution of the cohesive zone and of the breakdown process of a 3 – D fault governed by the classical slip – weakening model. We have presented our numerical scheme in Chapter 4.

The first condition is the resolution of the breakdown zone time or the breakdown zone size (see also Section C.2):

$$Dt << T_b \quad \text{or, alternatively,} \quad Dx << X_b \tag{F.1}$$

that can be re – written as:

$$Dt << \text{Min}\ \{\ T_b(t_1),\ T_b(t_3)\ \} \quad \text{or, alternatively,} \quad Dx << \text{Min}\ \{\ X_b(t_1),\ X_b(t_3)\ \} \tag{F.2}$$

where $T_b(t_1)$ and $T_b(t_3)$ are the breakdown zone time calculated for the time evolution of the 1 and 3 components of traction, respectively. We refer to a vertical fault, as depicted in Figure 4.1b. The breakdown zone times can be expressed as (see Appendix A of Bizzarri et al., 2001):

$$T_b(t_1) = d_0 \cos f \,/ < v >_{T_b(t_1)} \tag{F.3a}$$

$$T_b(t_1) = d_0 \sin f \,/ < v >_{T_b(t_2)} \tag{F.3b}$$

where f is the rake calculated in the actual fault point.

The second condition that we have to consider is the first neighbours decoupling:

$$D t \leq \frac{1}{\sqrt{\left(\frac{v_P}{D x_1}\right)^2 + \left(\frac{v_P}{D x_2}\right)^2 + \left(\frac{v_P}{D x_3}\right)^2}} \tag{F.4}$$

where $\{Dx_i\}$ are the spatial discretization of the R^3 domain.