

$$R_1 = - \left[ 2\sigma_1^2 M_{11} \frac{\partial^2 X_1}{\partial S_1^2} + 2\sigma_2^2 M_{11} \frac{\partial^2 X_1}{\partial S_2^2} \right] \\ - \frac{\partial M_{11}}{\partial X_1} \left[ \sigma_1^2 \frac{\partial X_1}{\partial S_1} \frac{\partial X_1}{\partial S_1} + \sigma_2^2 \frac{\partial X_1}{\partial S_2} \frac{\partial X_1}{\partial S_2} \right] \\ - 2 \frac{\partial M_{11}}{\partial X_2} \left[ \sigma_1^2 \frac{\partial X_2}{\partial S_1} \frac{\partial X_1}{\partial S_1} + \sigma_2^2 \frac{\partial X_2}{\partial S_2} \frac{\partial X_1}{\partial S_2} \right] \\ + \frac{\partial M_{22}}{\partial X_1} \left[ \sigma_1^2 \frac{\partial X_2}{\partial S_1} \frac{\partial X_2}{\partial S_1} + \sigma_2^2 \frac{\partial X_2}{\partial S_2} \frac{\partial X_2}{\partial S_2} \right] = 0$$

$$D_2(X_1) = - \left[ 2\sigma_1^2 M_{11} \frac{\partial^2 X_1}{\partial S_1^2} + 2\sigma_2^2 M_{11} \frac{\partial^2 X_1}{\partial S_2^2} \right]$$

$$D_2(\Delta X_1) = - \left[ 2\sigma_1^2 M_{11} \frac{\partial^2 \Delta X_1}{\partial S_1^2} + 2\sigma_2^2 M_{11} \frac{\partial^2 \Delta X_1}{\partial S_2^2} \right]$$

$$D_1 = - \frac{\partial M_{11}}{\partial X_1} \left[ \sigma_1^2 \left( \frac{\partial X_1}{\partial S_1} \frac{\partial X_1}{\partial S_1} + 2 \frac{\partial X_1}{\partial S_1} \frac{\partial \Delta X_1}{\partial S_1} \right) + \sigma_2^2 \left( \frac{\partial X_1}{\partial S_2} \frac{\partial X_1}{\partial S_2} + 2 \frac{\partial X_1}{\partial S_2} \frac{\partial \Delta X_1}{\partial S_2} \right) \right] \\ - 2 \frac{\partial M_{11}}{\partial X_2} \left[ \sigma_1^2 \left( \frac{\partial X_2}{\partial S_1} \frac{\partial X_1}{\partial S_1} + \frac{\partial X_2}{\partial S_1} \frac{\partial \Delta X_1}{\partial S_1} + \frac{\partial X_1}{\partial S_1} \frac{\partial \Delta X_2}{\partial S_1} \right) + \sigma_2^2 \left( \frac{\partial X_2}{\partial S_2} \frac{\partial X_1}{\partial S_2} + \frac{\partial X_2}{\partial S_2} \frac{\partial \Delta X_1}{\partial S_2} + \frac{\partial X_1}{\partial S_2} \frac{\partial \Delta X_2}{\partial S_2} \right) \right] \\ + \frac{\partial M_{22}}{\partial X_1} \left[ \sigma_1^2 \left( \frac{\partial X_2}{\partial S_1} \frac{\partial X_2}{\partial S_1} + 2 \frac{\partial X_2}{\partial S_1} \frac{\partial \Delta X_2}{\partial S_1} \right) + \sigma_2^2 \left( \frac{\partial X_2}{\partial S_2} \frac{\partial X_2}{\partial S_2} + 2 \frac{\partial X_2}{\partial S_2} \frac{\partial \Delta X_2}{\partial S_2} \right) \right]$$

$$D_1^{x_1} = - \frac{\partial M_{11}}{\partial x_1} \left[ \sigma_1^2 \left( \frac{\partial x_1}{\partial s_1} \right)^2 + \sigma_2^2 \left( \frac{\partial x_1}{\partial s_2} \right)^2 \right] \\ - 2 \frac{\partial M_{11}}{\partial x_2} \left[ \sigma_1^2 \left( \frac{\partial x_2}{\partial s_1} \frac{\partial x_1}{\partial s_1} \right) + \sigma_2^2 \left( \frac{\partial x_2}{\partial s_2} \frac{\partial x_1}{\partial s_2} \right) \right] \\ + \frac{\partial M_{22}}{\partial x_1} \left[ \sigma_1^2 \left( \frac{\partial x_2}{\partial s_1} \right)^2 + \sigma_2^2 \left( \frac{\partial x_2}{\partial s_2} \right)^2 \right]$$

$$D_1^{\Delta x_1} = - \frac{\partial M_{11}}{\partial x_1} \left[ \sigma_1^2 2 \frac{\partial x_1}{\partial s_1} \frac{\partial \Delta x_1}{\partial s_1} + \sigma_2^2 2 \frac{\partial x_1}{\partial s_2} \frac{\partial \Delta x_1}{\partial s_2} \right] \\ - 2 \frac{\partial M_{11}}{\partial x_2} \left[ \sigma_1^2 \left( \frac{\partial x_2}{\partial s_1} \frac{\partial \Delta x_1}{\partial s_1} + \frac{\partial x_1}{\partial s_1} \frac{\partial \Delta x_2}{\partial s_1} \right) \right. \\ \left. + \sigma_2^2 \left( \frac{\partial x_2}{\partial s_2} \frac{\partial \Delta x_1}{\partial s_2} + \frac{\partial x_1}{\partial s_2} \frac{\partial \Delta x_2}{\partial s_2} \right) \right] \\ + \frac{\partial M_{22}}{\partial x_1} \left[ \sigma_1^2 2 \frac{\partial x_2}{\partial s_1} \frac{\partial \Delta x_2}{\partial s_1} + \sigma_2^2 2 \frac{\partial x_2}{\partial s_2} \frac{\partial \Delta x_2}{\partial s_2} \right]$$

$$D_1^{x_2} (\cancel{M}) = - \frac{\partial M_{22}}{\partial x_1} \left[ \sigma_1^2 \left( \frac{\partial x_2}{\partial s_1} \right)^2 + \sigma_2^2 \left( \frac{\partial x_2}{\partial s_2} \right)^2 \right] \\ - 2 \frac{\partial M_{22}}{\partial x_1} \left[ \sigma_1^2 \left( \frac{\partial x_1}{\partial s_1} \frac{\partial x_2}{\partial s_1} \right) + \sigma_2^2 \left( \frac{\partial x_1}{\partial s_2} \frac{\partial x_2}{\partial s_2} \right) \right] \\ + \frac{\partial M_{11}}{\partial x_2} \left[ \sigma_1^2 \left( \frac{\partial x_1}{\partial s_1} \right)^2 + \sigma_2^2 \left( \frac{\partial x_1}{\partial s_2} \right)^2 \right]$$

$$D_1^{\Delta x_2} = - \frac{\partial M_{22}}{\partial x_1} \left[ \sigma_1^2 2 \frac{\partial x_2}{\partial s_1} \frac{\partial \Delta x_2}{\partial s_1} + \sigma_2^2 2 \frac{\partial x_2}{\partial s_2} \frac{\partial \Delta x_2}{\partial s_2} \right] \\ - 2 \frac{\partial M_{22}}{\partial x_1} \left[ \sigma_1^2 \left( \frac{\partial x_1}{\partial s_1} \frac{\partial \Delta x_2}{\partial s_1} + \frac{\partial x_2}{\partial s_1} \frac{\partial \Delta x_1}{\partial s_1} \right) \right. \\ \left. + \sigma_2^2 \left( \frac{\partial x_1}{\partial s_2} \frac{\partial \Delta x_2}{\partial s_2} + \frac{\partial x_2}{\partial s_2} \frac{\partial \Delta x_1}{\partial s_2} \right) \right] \\ + \frac{\partial M_{11}}{\partial x_2} \left[ \sigma_1^2 2 \frac{\partial x_1}{\partial s_1} \frac{\partial \Delta x_1}{\partial s_1} + \sigma_2^2 2 \frac{\partial x_1}{\partial s_2} \frac{\partial \Delta x_1}{\partial s_2} \right]$$

$$\text{Old: } x^{n+1} \cdot n = x^n \cdot n$$

$$\text{New: } \Delta x \cdot n = 0$$

$$\text{Old: } \frac{\partial}{\partial s_1} (x^{n+1} \cdot t) = 0$$

$$\text{New: } \frac{\partial}{\partial s_1} (\Delta x \cdot t) = - \frac{\partial}{\partial s_1} (x^n \cdot t)$$