Derivada Segunda

$$\frac{\partial^2 f(x_i, y_j)}{\partial x^2} \cong \frac{f(x_{i-1}, y_j) - 2f(x_i, y_j) + f(x_{i+1}, y_j)}{h_x^2}$$

$$\frac{\partial^2 f(x_i, y_j)}{\partial y^2} \cong \frac{f(x_i, y_{j-1}) - 2f(x_i, y_j) + f(x_i, y_{j+1})}{h_y^2}$$

$$h_x = x_{i+1} - x_i$$

$$h_y = y_{j+1} - y_j$$

$$\frac{\partial^2 f(x_i, y_j)}{\partial x \partial y} \cong \frac{f(x_{i+1}, y_{j+1}) - f(x_{i-1}, y_{j+1})}{4 h_x \cdot h_y} + \frac{f(x_{i-1}, y_{j-1}) - f(x_{i+1}, y_{j-1})}{4 h_x \cdot h_y}$$

Vetor Normal

$$X(u,v) = (x(u,v), y(u,v), z(u,v))$$

$$X_u = (x_u, y_u, z_u), \quad X_v = (x_v, y_v, z_v)$$

$$X_u \times X_v = \begin{vmatrix} i & j & k \\ x_u & y_u & z_u \\ x_v & y_v & z_v \end{vmatrix} = (y_u z_v - y_v z_u, x_v z_u - x_u z_v, x_u y_v - x_v y_u)$$

$$|X_u \times X_v| = \sqrt{(y_u z_v - y_v z_u)^2 + (x_v z_u - x_u z_v)^2 + (x_u y_v - x_v y_u)^2}$$

$$N(u,v) = \frac{X_u \times X_v}{|X_u \times X_v|}(u,v)$$