We wish to implement the formula

$$(1) \qquad D \equiv \frac{e^{-rT}\Delta^2}{(2\pi)^2} \sum_{k_1,k_2=1}^{N} e^{i(\Delta(k_1-N/2-1)+i\epsilon_1,\Delta(k_1-N/2-1)+i\epsilon_2)\cdot(X_1,X_2)} F(k_1,k_2),$$

where

$$F(k_1,k_2) = \Phi\left(\Delta(k_1-N/2-1)+i\epsilon_1, \Delta(k_1-N/2-1)+i\epsilon_2\right) \\ \times \widehat{P}\left(\Delta(k_1-N/2-1)+i\epsilon_1, \Delta(k_1-N/2-1)+i\epsilon_2\right),$$

Φ is the characteristic function and $\widehat{P}$ is the Fourier transform of the payoff (and this can be the payoff for spread options or basket options). Now by setting

$$X_1 = X_{01} + \lambda(\ell-1), \quad X_2 = X_{02} + \lambda(m-1), \quad \ell, m = 1, \ldots, N$$

and

$$\lambda = \frac{2\pi}{N\Delta},$$

we rewrite (1) as

(2)

$$\frac{e^{-rT}\Delta^2}{(2\pi)^2} e^{V_1(\ell)+V_2(m)} \sum_{k_1,k_2=1}^{N} e^{i\frac{2\pi}{N}[(k_1-1)(\ell-1)+(k_2-1)(m-1)]} e^{i\Delta(k_1X_{01}+k_2X_{02})} F(k_1,k_2),$$

with

$$V_1(\ell) = (-\epsilon_1 - i\Delta(N/2+1))\left(X_{01} + \frac{2\pi}{N\Delta}(\ell-1)\right) + i\frac{2\pi}{N}(\ell-1),$$

and

$$V_2(m) = (-\epsilon_2 - i\Delta(N/2+1))\left(X_{02} + \frac{2\pi}{N\Delta}(m-1)\right) + i\frac{2\pi}{N}(m-1).$$

Note that inside the summation we have the two-dimensional discrete Fourier transform of the matrix

$$A_{(k_1k_2)} \equiv e^{i\Delta(k_1X_{01}+k_2X_{02})} F(k_1,k_2);$$

its Fast Fourier transform will produce a matrix

$$B_{\ell m} = \{b_{\ell m}\};$$

now the matrix

$$C = \{c_{\ell m}\} = \left\{ \frac{e^{-rT}\Delta^2}{(2\pi)^2} e^{V_1(\ell)+V_2(m)} b_{\ell m} \right\}$$

will give the call option price for each choice of share values

$$(X_\ell, X_m) = (X_{01} + \lambda(\ell-1), X_{02} + \lambda(m-1)).$$

Let me know if something is not clear.