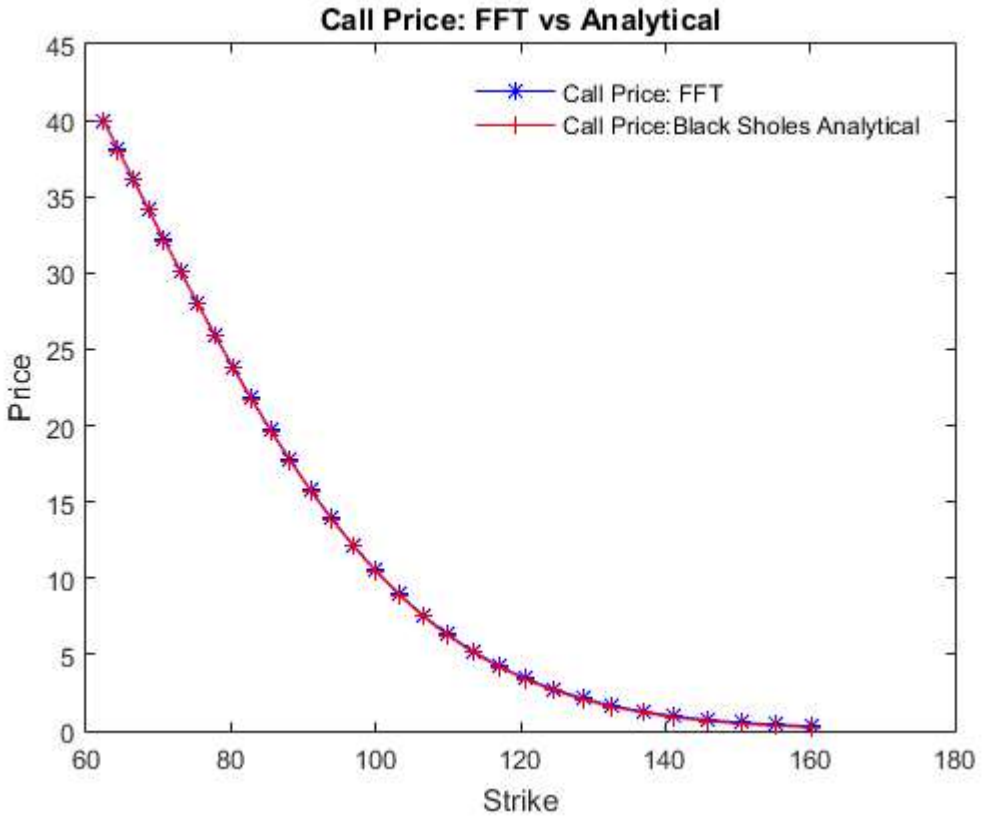
```
% Fast Fourier Transform for the Black Scholes Model

% ---------------------------------------
% Inputs
%   N  = number of discretization points
%   uplimit = Upper limit of integration
%   S0 = spot price
%   r = risk free rate
%   tau = maturity
%   sigma = volatility
%   alpha = dampening factor
%   fast = fast versus slow algorithm.
%     fast = 1 fast version.  Uses vectorization.
%     fast = 0 slow version.  Uses loops
% ---------------------------------------
% Outputs
%   CallFFT = Black Scholes call prices using FFT
%   CallBS  = Black Scholes call prices using closed form
%         K = Strike prices
%       eta = increment for integration range
%    lambda = increment for log-strike range
% ---------------------------------------
% Implemented by Saeed Rahman

clc; clear;

% Required inputs
S0 = 100;           % Spot price.
r = 0.05;           % Risk free rate.
q = 0.01;           % Dividend yield
tau = .75;          % Time to maturity.
sigma = 0.25;       % Volatility
alpha = 1.75;      % Dampening factor
N = 128;            % Grid size
uplimit = 200;      % Upper limit of integration
fast = 0;           % Choice of fast or slow algorithm

% Run the Fast Fourier Transform
[CallFFT CallBS K lambda eta] = BlackScholesFFT(N,uplimit,S0,r,q,tau,sigma,alpha,fast);

% Print the results near the ATM strikes
disp('  Strikes    FFT Price  Analytical Price')
u1 = find(round(K*1000)/1000==S0);
du = 15;
[K(u1-du:u1+du) CallFFT(u1-du:u1+du), CallBS(u1-du:u1+du)]

% Print the increments for integration and for log strikes
IntegrationIncrement = eta
LogStrikeIncrement = lambda
NumberOfPoints = N


plot(K(u1-du:u1+du), CallFFT(u1-du:u1+du),'b*-',K(u1-du:u1+du), CallBS(u1-du:u1+du),'r+-')
legend('Call Price: FFT ','Call Price:Black Sholes Analytical')
legend('boxoff')
xlabel('Strike') % x-axis label
ylabel('Price') % y-axis label
title('Call Price: FFT vs Analytical')
```

```
  Strikes    FFT Price  Analytical Price

ans =

   62.4228   40.0145   39.9275
   64.4150   38.1246   38.0376
   66.4708   36.1872   36.1003
   68.5922   34.2058   34.1189
   70.7813   32.1850   32.0982
   73.0403   30.1316   30.0448
   75.3713   28.0540   27.9672
   77.7768   25.9626   25.8759
   80.2590   23.8699   23.7831
   82.8204   21.7900   21.7033
   85.4636   19.7389   19.6523
   88.1911   17.7336   17.6470
   91.0057   15.7916   15.7051
   93.9101   13.9304   13.8439
   96.9072   12.1665   12.0800
  100.0000   10.5147   10.4283
  103.1915    8.9874    8.9010
  106.4848    7.5941    7.5078
  109.8832    6.3408    6.2545
  113.3901    5.2297    5.1435
  117.0089    4.2596    4.1734
  120.7432    3.4257    3.3396
  124.5966    2.7203    2.6343
  128.5731    2.1335    2.0475
  132.6765    1.6535    1.5675
  136.9108    1.2674    1.1816
  141.2802    0.9624    0.8766
  145.7891    0.7257    0.6400
  150.4419    0.5452    0.4595
  155.2432    0.4101    0.3245
  160.1978    0.3108    0.2253


IntegrationIncrement =

    1.5625


LogStrikeIncrement =

    0.0314


NumberOfPoints =

   128
```



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