New NAG routine adds term structure to the Heston stochastic volatility model of the market

One of the simplest option pricing models is that of Black-Scholes. This model assumes that the observed price in the market of a given option is constant across a variety of options on the same asset with different strike prices. It may be readily observed that this is not the case and so more refined models have been introduced. One of the most popular is that due to Heston.

The Heston stochastic volatility model assumes that the volatility of an asset follows a random process. It attempts to re-create market pricing by using stochastic processes to model both volatility and interest rates. The Heston model is characterized by the inclusion of the square root of a volatility function in the overall pricing function. In the general case some of the parameters are time dependent. These parameters are ALPHA, the value of the volatility of the scaled volatility, LAMBDA, the mean reversion parameter, CORR, the correlation parameter and SIGMA, the variance scale factor. The routine introduced in the NAG C Library at Mark 24 allows these time-dependent parameters to be modelled by piecewise constant functions to facilitate a numerical solution.

The option price is computed by dividing the time to expiry into subintervals, or 'terms', and applying the method of characteristic functions to each subinterval, with appropriate initial conditions. Thus a pair of ordinary differential equations is solved in each subinterval.

The number of these subintervals is controlled by the user. For convenience the final subinterval length may be determined, shortened or lengthened automatically to match the appropriate parameter values so that the full range to expiry is covered exactly.

The output from the routine consists of a vector of option prices corresponding to the strike prices provided. The user may specify that either CALL or PUT options are priced.