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# fps2d

## 1 Description

We consider a two-factor stochastic volatility model  $(S_t, Y_t, Z_t)$ , where  $S_t$  is the underlying price, and  $Y_t$  and  $Z_t$  are correlated diffusion processes. Under the risk-neutral probability measure, the model is described by the following equations:

$$\begin{aligned} dS_t &= rS_t dt + \sigma_t S_t dW_t^S, \\ \sigma_t &= f(Y_t, Z_t), \\ dY_t &= \left( \alpha(m_f - Y_t) - \nu_f \sqrt{2\alpha} \mathfrak{l}_f(Y_t, Z_t) \right) dt \\ &\quad + \nu_f \sqrt{2\alpha} \left( \rho_1 dW_t^S + \sqrt{1 - \rho_1^2} dW_t^Y \right), \\ dZ_t &= \left( \delta(m_s - Z_t) - \nu_s \sqrt{2\delta} \mathfrak{l}_s(Y_t, Z_t) \right) dt \\ &\quad + \nu_s \sqrt{2\delta} \left( \rho_2 dW_t^S + \rho_{12} dW_t^Y + \sqrt{1 - \rho_2^2 - \rho_{12}^2} dW_t^Z \right). \end{aligned}$$

Here  $(W_t^S, W_t^Y, W_t^Z)$  are independent standard Brownian motions, and the correlation coefficients  $\rho_1$ ,  $\rho_2$ , and  $\rho_{12}$  satisfy  $-1 < \rho_1 < 1$ ,  $\rho_2^2 + \rho_{12}^2 < 1$  respectively.

## 2 Code Implementation

```
#ifndef _FPS2D_H
#define _FPS2D_H

#include "optype.h"
#include "var.h"
#include "error_msg.h"
```

```
#define TYPEMOD FPS2D

/*2D Fouque Papanicolau Sircar World*/
typedef struct TYPEMOD
{
    VAR T;
    VAR S0;
    VAR Divid;
    VAR R;
    VAR InitialSlow;
    VAR InitialFast;
    VAR SigmaSlow;
    VAR SigmaFast;
    VAR MeanReversionSlow;
    VAR MeanReversionFast;
    VAR LongRunVarianceSlow;
    VAR LongRunVarianceFast;
    VAR Rho1;
    VAR Rho2;
    VAR Rho12;
} TYPEMOD;

#endif
```