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#if defined(PremiaCurrentVersion) && PremiaCurrentVersion < (2007+2) //The "#els
#else

#ifndef QUADRATICMODEL_H
#define QUADRATICMODEL_H

#include "
href../../common/math/read_market_zc/InitialYieldCurve_h_src.pdfmath/read_mar

/**
The instantaneous sport interest rate  $r_t$  is described by  $r_t = 0.5 \cdot x_t^2$ , with

 $dx_t = (\alpha_t - \beta \cdot x_t) \cdot dt + \sigma \cdot dW_t$ 
 $x_0 = \sqrt{2 \cdot r_0}$ 
**/

// Strucure which contains information on the the T-maturity zc bond at time t=0
//  $P(0, T) = \exp(- (B \cdot r + b \cdot \sqrt{2 \cdot r}) + c)$ 
typedef struct
{
    double T;
    double P; // Price of the T-maturity bond at time t=0
    double f0_T; // T-maturity forward rate at time t=0
    double B; // Coefficients of the T-maturity bond at time t=0 :  $P(0,T)=\exp(-(.5$ 
    double b;
    double c;
    double dB; // Derivatives of B and b with respect to T
    double db;
    double V; // Variance of x under the T-forward probability
} Data;

// Coefficents of the omega distribution :  $.5 \cdot B \cdot x^2 + bx + c$  where x is normally dis
typedef struct
{
    double B;
    double b;
    double c;
    double mu;
```

```

    double V;
} Omega;

// coefficients of the chi^2 distribution : alpha+beta X where X is non centrally
typedef struct
{
    double nu;
    double lambda;
    double beta;
    double alpha;
} Chn;

// Computes the strcuture data at time T
void bond_coeffs(ZCMarketData *ZCMarket, Data *data, double T, double beta, double sigma)

// Gives the omega distribution of the zero-coupon bond P(T, S) data1 contains t
void transport(Omega *om, Data data1, Data data2, double beta, double sigma, double T)

// Transforms Omega distribution to a chi^2 distribution
void om2chn(Omega om, Chn *chn);

// Compute the initial rate r_0 and corresponding value x_0
void initial_short_rate(ZCMarketData *ZCMarket, double *r0, double *x0);

/* Price of a european option on zero coupon bond*/
double zb_call_quad1d(ZCMarketData *ZCMarket, double beta, double sigma, double T, double K)
double zb_put_quad1d(ZCMarketData *ZCMarket, double beta, double sigma, double T, double K)

#endif
#endif //PremiaCurrentVersion

```