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#include "vasicek1d_std.h"

static int nb_payement;
static double A, B;

/*Zero Coupon Bond*/
static double zcb_vasicek1d(double theta, double r, double k, double sigma, double Ti, double ti)
{
    B = (1. / k) * (1. - exp(-k * (Ti - ti)));
    A = exp((theta - SQR(sigma) / (2.*SQR(k))) * (B - Ti + ti) - (SQR(sigma) / (4. * k) * (B - Ti + ti)));
    return A * exp(-B * r);
}

/*Call Option on Zero Coupon Bond*/
static double zbc_vasicek1d(double t, double T, double S, double r, double k, double sigma, double new_K)
{
    double PtS, PtT;
    double d1, d2, sigma_p;
    double new_K;

    new_K = 1. / (1. + K * periodicity);

    PtT = zcb_vasicek1d(theta, r, k, sigma, t, T);
    PtS = zcb_vasicek1d(theta, r, k, sigma, t, S);
    sigma_p = sigma * sqrt((1. - exp(-2.*k * (T - t))) / (2 * k)) * (1. / k) * (1. / sigma);
    d1 = 1. / (sigma_p) * log(PtS / (PtT * new_K)) + 0.5 * sigma_p;
    d2 = d1 - sigma_p;

    return PtS * cdf_nor(d1) - new_K * PtT * cdf_nor(d2);
}

/*Floor*/
static int floor_vasicek1d(double r, double k, double date, double sigma, double K, double T)
{
    double sum, tim, tip;
    int i;
```

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    nb_payment = (int)((contract_maturity - first_payment) / periodicity);

    /*Floor=Portfolio of zero-bond Call options*/
    sum = 0.;
    for (i = 0; i < nb_payment; i++)
    {
        tim = first_payment + (double)i * periodicity;
        tip = tim + periodicity;
        sum += (1. + K * periodicity) * zbc_vasicek1d(date, tim, tip, r, k, theta,
    }

    /*Price*/
    *price = Nominal * sum;

    return OK;
}

int CALC(CF_Floor)(void *Opt, void *Mod, PricingMethod *Met)
{
    TYPEOPT *ptOpt = (TYPEOPT *)Opt;
    TYPEMOD *ptMod = (TYPEMOD *)Mod;

    return floor_vasicek1d(ptMod->r0.Val.V_PDOUBLE, ptMod->k.Val.V_DOUBLE, ptMod->

}

static int CHK_OPT(CF_Floor)(void *Opt, void *Mod)
{
    return strcmp(((Option *)Opt)->Name, "Floor");
}

static int MET(Init)(PricingMethod *Met, Option *Opt)
{
    if (Met->init == 0)
    {
        Met->init = 1;
    }

    return OK;
}

```

```
PricingMethod MET(CF_Floor) =  
{  
    "CF_Vasicek1d_Floor",  
    {{ " ", PREMIA_NULLTYPE, {0}, FORBID}},  
    CALC(CF_Floor),  
    {{ "Price", DOUBLE, {100}, FORBID}, { " ", PREMIA_NULLTYPE, {0}, FORBID}},  
    CHK_OPT(CF_Floor),  
    CHK_ok,  
    MET(Init)  
} ;
```