

[Help](#)

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#include <stdlib.h>
#include "bs1d_std.h"
#include "error_msg.h"
#define PRECISION 1.0e-7 /*Precision for the localization of FD methods*/

static int Sor(double s, NumFunc_1 *p, double t, double r, double divid, double
{
    double k, z, l, h, vv, alpha, beta, gamma, alpha1, beta1, gamma1, x, y, error,
    int i, j, Index, loops;
    double *P, *Rhs;

    /*Memory Allocation*/
    if (N % 2 == 1) N++;
    P = malloc((N + 1) * sizeof(double));
    if (P == NULL)
        return MEMORY_ALLOCATION_FAILURE;
    Rhs = malloc((N + 1) * sizeof(double));
    if (Rhs == NULL)
        return MEMORY_ALLOCATION_FAILURE;

    /*Time Step*/
    k = t / (double)M;

    /*Space Localisation*/
    z = (r - divid) - SQR(sigma) / 2.0;
    l = sigma * sqrt(t) * sqrt(log(1.0 / PRECISION)) + fabs(z) * t;

    /*Space Step*/
    h = 2.0 * l / (double)N;

    /*Peclet Condition-Coefficient of diffusion augmented */
    vv = 0.5 * SQR(sigma);
    if ((h * fabs(z)) <= vv)
        upwind_alphacoef = 0.5;
    else
    {
        if (z > 0.) upwind_alphacoef = 0.0;
        else upwind_alphacoef = 1.0;
    }
}

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    }
    vv -= z * h * (upwind_alphacoef - 0.5);

    /*Lhs factor of theta-schema*/
    alpha = theta * k * (-vv / (h * h) + z / (2.0 * h));
    beta = 1.0 + k * theta * (r + 2.*vv / (h * h));
    gamma = k * theta * (-vv / (h * h) - z / (2.0 * h));

    /*Rhs factor of theta-schema*/
    alpha1 = k * (1.0 - theta) * (vv / (h * h) - z / (2.0 * h));
    beta1 = 1.0 - k * (1.0 - theta) * (r + 2.*vv / (h * h));
    gamma1 = k * (1.0 - theta) * (vv / (h * h) + z / (2.0 * h));

    /*Terminal Values*/
    x = log(s);
    for (i = 0; i <= N; i++)
        P[i] = (p->Compute)(p->Par, exp(x - l + (double)i * h));

    /*Finite Difference Cycle*/
    for (i = 1; i <= M; i++)
    {
        /*Init Rhs*/
        for (j = 1; j < N; j++)
            Rhs[j] = alpha1 * P[j - 1] + beta1 * P[j] + gamma1 * P[j + 1];

        /*Sor Cycle*/
        loops = 0;
        do
        {
            error = 0.;
            norm = 0.;

            for (j = 1; j < N; j++)
            {
                y = (Rhs[j] - alpha * P[j - 1] - gamma * P[j + 1]) / beta;
                y = P[j] + omega * (y - P[j]);

                error += (double)(j + 1) * fabs(y - P[j]);
                norm += fabs(y);
                P[j] = y;
            }

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        if (norm < 1.0) norm = 1.0;
        error = error / norm;

        loops++;
    }
    while ((error > epsilon) && (loops < MAXLOOPS));
    /*End Sor Cycle*/
}
/*End Finite Difference Cycle*/

Index = (int) floor((double)N / 2.0);

/*Price*/
*ptprice = P[Index];

/*Delta*/
*ptdelta = (P[Index + 1] - P[Index - 1]) / (2.0 * s * h);

/*Memory Desallocation*/
free(P);
free(Rhs);

return OK;
}

int CALC(FD_Sor)(void *Opt, void *Mod, PricingMethod *Met)
{
    TYPEOPT *ptOpt = (TYPEOPT *)Opt;
    TYPEMOD *ptMod = (TYPEMOD *)Mod;
    double r, divid;

    r = log(1. + ptMod->R.Val.V_DOUBLE / 100.);
    divid = log(1. + ptMod->Divid.Val.V_DOUBLE / 100.);

    return Sor(ptMod->S0.Val.V_PDOUBLE, ptOpt->PayOff.Val.V_NUMFUNC_1,
               ptOpt->Maturity.Val.V_DATE - ptMod->T.Val.V_DATE, r, divid,
               ptMod->Sigma.Val.V_PDOUBLE,
               Met->Par[0].Val.V_INT, Met->Par[1].Val.V_INT,
               Met->Par[2].Val.V_RGDOUBLE, Met->Par[3].Val.V_RGDOUBLE, Met->Par[4]
               &(Met->Res[0].Val.V_DOUBLE), &(Met->Res[1].Val.V_DOUBLE));
}

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}

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```
static int CHK_OPT(FD_Sor)(void *Opt, void *Mod)
{
    Option *ptOpt = (Option *)Opt;
    TYPEOPT *opt = (TYPEOPT *) (ptOpt->TypeOpt);

    if ((opt->EuOrAm). Val.V_BOOL == EURO)
        return OK;

    return WRONG;
}

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

        Met->Par[0].Val.V_INT2 = 100;
        Met->Par[1].Val.V_INT2 = 100;
        Met->Par[2].Val.V_RGDOUBLE = 0.5;
        Met->Par[3].Val.V_RGDOUBLE = 1.5;
        Met->Par[4].Val.V_RGDOUBLE = 0.000001;

    }

    return OK;
}

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```
PricingMethod MET(FD_Sor) =
{
    "FD_Sor",
    { {"SpaceStepNumber", INT2, {100}, ALLOW }, {"TimeStepNumber", INT2, {100}, A
        {"Theta", RGDOUBLE051, {100}, ALLOW}, {"Omega", RGDOUBLE12, {100}, ALLOW},
    },
    CALC(FD_Sor),
    {"Price", DOUBLE, {100}, FORBID}, {"Delta", DOUBLE, {100}, FORBID} , {" ", PR
    CHK_OPT(FD_Sor),
    CHK_psor,

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    MET(Init)  
};
```