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 sigma,int N,int M,double theta,double omega,
    double epsilon,double *ptprice,double *ptdelta)
{
  double k,z,l,h,vv,alpha,beta,gamma,alpha1,beta1,gamma1,x,
    y,error,norm,upwind_alphacoef;
  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 {
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  if (z>0.) upwind_alphacoef=0.0;
  else  upwind_alphacoef=1.0;
}
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);
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        P[j]=y;
      }

    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,
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        Met->Par[0].Val.V_INT,Met->Par[1].Val.V_INT,
        Met->Par[2].Val.V_RGDOUBLE,Met->Par[3].Val.V_RG
    DOUBLE,Met->Par[4].Val.V_RGDOUBLE,
        &(Met->Res[0].Val.V_DOUBLE),&(Met->Res[1].Val.V_
    DOUBLE));
}

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;
}

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;
}

PricingMethod MET(FD_Sor)=
{
  "FD_Sor",
  {{"SpaceStepNumber",INT2,{100},ALLOW  },{"TimeStepNumber"
    ,INT2,{100},ALLOW},
```

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   {"Theta",RGDOUBLE051,{100},ALLOW},   {"Omega",RGDOUBLE12
    ,{100},ALLOW}, {"Epsilon",RGDOUBLE,{100},ALLOW},{" ",PREM
    IA_NULLTYPE,{0},FORBID}},
  CALC(FD_Sor),
  {{"Price",DOUBLE,{100},FORBID},{"Delta",DOUBLE,{100},FORB
    ID} ,{" ",PREMIA_NULLTYPE,{0},FORBID}},
  CHK_OPT(FD_Sor),
  CHK_psor,
  MET(Init)
};
```

References