

fd_adi

Input parameters:

- TimeStepNumber M
- SpaceStepNumber N

Output parameters:

- Price
- Delta1
- Delta2

Alternate Direction Implicit methods were proposed by Peachman Rachford ([2]. At each time step, one can integrate “in each direction”(cf.[there](#)).

In the american case to solve the inequality one combines the projection by the splitting scheme with A.D.I. finite difference method. The idea of this scheme ([1]) is to split the American problem in twosteps(cf.[there](#)).

/*Memory Allocation*/

/*Covariance Matrix*/

/*Space localisation*/

Define the integration domain $D = [-l, l]^2$ using probabilistic estimation.

/*Space Step*/

Define the space step $h = \frac{2l}{M}$.

/*Time Step*/

/*Rhs Factor of first step*/

The right-hand side factor of the first step of ADI scheme.

/*Rhs Factor of second step*/

The right-hand side factor of the second step of ADI scheme.

/*Terminal Values*/

Put the value of the payoff into a vector P

/*Homegenous Dirichlet Conditions*/

/*Finite difference Cycle*/

At any time step, described by the loop in the variable *TimeIndex*, we have to solve the system (cf. [there](#))

/*First step*/

First step of ADI scheme.

/*Init Rhs*/

Compute the right-hand side.

/*Gauss Algorithm*/

Resolution of linear system with Gauss method. (cf. [there](#))

/*Second step*/

First step of ADI scheme.

/*Init Rhs*/

Compute the right-hand side.

/*Gauss Algorithm*/

Resolution of linear system with Gauss method. (cf. [there](#))

/*Splitting for American case*/

For American options, we compare at each time step the solution in P with the payoff function saved in *iv*. We save the result in P

`/*Price*/`

`/*Delta*/`
cf. [there](#).

`/*Memory Desallocation*/`

References

- [1] S.VILLENEUVE A.ZANETTE. Parabolic A.D.I. methods for pricing american option on two stocks. *Mathematics of Operations Research*, pages 121–151, Feb 2002. [1](#)
- [2] D.W.PEACEMAN-H.H.RACHFORD Jr. The numerical solution of parabolic and elliptic differential equations. *J.of Siam*, 3:28–42, 1955. [1](#)