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fd_gauss_vasicek1d_swaption

Input parameters:

- Space StepNumber N_r
- Time StepNumber M

Output parameters:

- Price

The stochastic differential equation representing the short rate is given by

$$dr_t = k(\theta - r_t)dt + \sigma dW(t)$$

The price of the zero-coupon bond with maturity $S > T$ is solution of the following PDE

$$u_t + \frac{1}{2}\sigma^2 u_{rr} + [k(\theta - r)]u_r - ru = 0, u(r, S, S) = 1$$

that we solve using standard Crank-Nicholson. We apply Dirichlet boundary conditions at $r = r_{min}$ and $r = r_{max}$. The price of the option is obtained solving the same PDE with boundary condition at the maturity of the option T , the price of the Zero Coupon Bond. The price of the coupon bearing is obtained as linear combination of zero-coupon prices, taking in account properly of the coupon adjustment. A swaption can also be seen as an option of strike 1 over a certain coupon bearing.

References