

Docu for IntegratorXL_doubleIntegral.xls

The generalities for using the integrator are already described there.

This here only shows how to use it for double integrals and for that as example the cumulative bivariate normal distribution is chosen:

$$\text{cdfN2} := (x, y, \rho) \rightarrow \frac{1}{2} \left(\frac{1}{\sqrt{1-\rho^2} \pi} \int_{-\infty}^x \int_{-\infty}^y e^{\left(-\frac{1}{2} \frac{\xi^2 - 2\rho\xi\eta + \eta^2}{1-\rho^2} \right)} d\eta d\xi \right)$$

Up to a scaling factor we need the Gauss kernel

$$\text{kernel} := \eta \rightarrow e^{\left(-\frac{\xi^2 - 2\rho\xi\eta + \eta^2}{2(1-\rho^2)} \right)}$$

which can be seen as a function of η while ξ, ρ are considered as global parameters (denoted g_xi and g_rho in the VBA module).

Then $\text{innerIntegral} := \xi \rightarrow \int_{-y}^{\infty} \text{kernel}(\eta) d\eta$ is a function of ξ , the integrator

can be applied again to get $\text{doubleIntegral} := x \rightarrow \int_{-x}^{\infty} \text{innerIntegral}(\xi) d\xi$.

Flipping the integral by changing the signs of the variables one gets

$$\frac{1}{2} \frac{\text{doubleIntegral}(x)}{\sqrt{1-\rho^2} \pi} = \frac{1}{2} \left(\frac{1}{\sqrt{1-\rho^2} \pi} \int_{-\infty}^x \int_{-\infty}^y e^{\left(-\frac{\xi^2 - 2\rho\xi\eta + \eta^2}{2(1-\rho^2)} \right)} d\eta d\xi \right) =$$

$= \text{cdfN2}(x, y, \rho)$ as desired, since $\text{pdfN2}(x, y, \rho) = \text{pdfN2}(-x, -y, \rho)$.

For proper processing the global variables g_xi , g_eta and g_rho are used.

AVt, March 2005