When using the Gaussian kernel, we can estimate the copula-based kernel independence measure $I^2(X)$ as

$$\begin{aligned}\mathcal{M}_u^2[\mathcal{F}, \boldsymbol{Z}_{1:m}, P_U] = &\frac{1}{m(m-1)} \sum_{i \neq j} k(\boldsymbol{Z}_i, \boldsymbol{Z}_j) \\ &- \frac{2}{m} \sum_{i=1}^{m} \prod_{j=1}^{d} \int_0^1 \exp\left(\frac{-(\boldsymbol{Z}_i^j - u)^2}{2\sigma^2} \right) du \\ &+ \left(\int_0^1 \int_0^1 \exp\left(\frac{-(u-u')^2}{2\sigma^2} \right) du du' \right)^d\end{aligned} \tag{1}$$

Let us write the integral terms as a function of the Gaussian error function, and using $\gamma = \frac{1}{2\sigma^2}$

$$\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x \exp(-t^2) dt$$

We have that

$$\int_0^1 \exp\left(\frac{-(\boldsymbol{Z}_{ij} - u)^2}{2\sigma^2} \right) du = 2\sigma^2 \int_{\frac{-\boldsymbol{Z}_{ij}}{2\sigma^2}}^{\frac{1-\boldsymbol{Z}_{ij}}{2\sigma^2}} \exp(-t^2) dt \tag{2}$$

$$= \frac{\sqrt{\pi}}{2\gamma} [\operatorname{erf}(\gamma(1 - \boldsymbol{Z}_{ij})) + \operatorname{erf}(\gamma \boldsymbol{Z}_{ij})] \tag{3}$$

and since

$$\int_0^z \operatorname{erf}(x) dx = z\operatorname{erf}(z) + \frac{\exp(-z^2)}{\sqrt{\pi}} \tag{4}$$

we have that

$$\int_0^1 \int_0^1 \exp\left(\frac{-(u-u')^2}{2\sigma^2} \right) du du' = 2\sigma^2 \int_0^1 \int_{\frac{-u'}{2\sigma^2}}^{\frac{1-u'}{2\sigma^2}} \exp(-z^2) dz du' \tag{5}$$

$$= \frac{\sqrt{\pi}}{2\gamma} \int_0^1 [\operatorname{erf}(\gamma(1-u')) + \operatorname{erf}(\gamma u')] du' \tag{6}$$

$$= \frac{\sqrt{\pi}}{\gamma} \left[\operatorname{erf}(\gamma) - \frac{\exp(-\gamma^2)}{\gamma\sqrt{\pi}} + \frac{1}{\gamma\sqrt{\pi}} \right] \tag{7}$$

This finally yields

$$\begin{aligned}\mathcal{M}_u^2[\mathcal{F}, \boldsymbol{Z}_{1:m}, P_U] = &\frac{1}{m(m-1)} \sum_{i \neq j} k(\boldsymbol{Z}_i, \boldsymbol{Z}_j) \\ &- \frac{2}{m} \sum_{i=1}^{m} \prod_{j=1}^{d} \left[\frac{\sqrt{\pi}}{2\gamma} [\operatorname{erf}(\gamma(1 - \boldsymbol{Z}_{ij})) + \operatorname{erf}(\gamma \boldsymbol{Z}_{ij})] \right] \\ &+ \left[\frac{\sqrt{\pi}}{\gamma} \left[\operatorname{erf}(\gamma) - \frac{\exp(-\gamma^2)}{\gamma\sqrt{\pi}} + \frac{1}{\gamma\sqrt{\pi}} \right] \right]^d\end{aligned} \tag{8}$$