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Some Comments Concerning the Application of the Discrete Eigenvalue Theory

The analytical solution to the integral of the form

$$J(c) + \int_0^1 arctg \left\{ \frac{C\pi \mathrm{x}}{2(1 - c\pi arctgh(\mathrm{x}))} \right\} \mathrm{x} d\mathrm{x}$$

is obtained, by application of the Transcendental Method Theory [1] and Discrete Eigenvalue Theory [2], in the form
$J(c) = \frac{3-2c}{3-3c} - ((disperz(c)))^2$, where disperz($c$) is the novel special function defined as

$$disperz(c(z)) = \lim_{y\to\infty} \left\{ In \left[\frac{\frac{\partial}{\partial y}(N(z, y - f(z))exp(y - f(z)))}{\frac{\partial}{\partial y}(N(z,y)exp(y))} \right] \right\}$$

where

$$N(z, y) = \sum_{n=0}^{[y/f(z)]} \sum_{k=0}^{n} (-1)^n e^{-nf(z)} \frac{2^k (y - nf(z))^k}{(n-k)!k!k!}, \qquad f = 2/c.$$

Or, more explicitly, we have

disperz(c) =

$$\frac{\sum\limits_{n=0}^{N-1} \sum\limits_{k=0}^{n} (-1)^n e^{-nf} \frac{(2f)^k (N-1-n)^k n!}{(n-k)!k!k!} + \sum\limits_{n=0}^{N-1} \sum\limits_{k=0}^{n} (-1)^n e^{-nf} \frac{(2f)^k (N-1-n)^k n!}{(n-k)!(k-1)!k!} +}{\sum\limits_{n=0}^{N} \sum\limits_{k=0}^{n} (-1)^n e^{-nf} \frac{(2f)^k (N-n)^k n!}{(n-k)!k!k!} + \sum\limits_{n=0}^{N} \sum\limits_{k=0}^{n} (-1)^n e^{-nf} \frac{(2f)^k (N-n)^k n!}{(n-k)!(k-1)!k!} +}$$

References: [1] Perovich, S. M. Transport Theory and Statistical Physics, 1997, **26**, 705. [2] Siewert, C. E., Journal of Mathematical Physics, 1980, **21**, 2468.