

Katugampola Fractional Derivative

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February 20, 2025

1 Derivation of Katugampola Fractional Derivative

The Katugampola Fractional Derivative is a generalization of classical derivative as defined in Equation 1

$$D_a^\alpha f(x) = \frac{1}{\Gamma(m-\alpha)} \frac{d^m}{dx^m} \int_0^x (x-t)^{m-\alpha-1} f(t) dt, \quad (1)$$

where $m = \lceil a \rceil$ and $\alpha \in (0, 1)$.

$$I_{0+}^\alpha f(x) = \frac{1}{\Gamma(\alpha)} \int_0^x (x-t)^{\alpha-1} f(t) dt, \quad (2)$$

with $0 < \alpha < 1$.

$$\begin{aligned} D_a^\alpha f(x) &= \frac{1}{\Gamma(m-\alpha)} \frac{d^m}{dx^m} I_{0+}^\alpha f(x) \\ &= \frac{1}{\Gamma(m-\alpha)} \frac{d^m}{dx^m} \left(\frac{1}{\Gamma(\alpha)} \int_0^x (x-t)^{\alpha-1} f(t) dt \right). \end{aligned} \quad (3)$$

2 Conclusion

Replicating references to (1), (2), (3)