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THE KAMAL TRANSFORM OF DERIVED FUNCTION DEMONSTRATED BY HEAVISIDE FUNCTION

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Abstract: We have demonstrated that the Kamal transform of derived function can be demonstrated by an infinite arrangement or Heaviside function. Identified with this theme, the advanced thought can be likewise connected to additional changes.

Keywords: Kamal transform, Heaviside function.
Mathematics Subject Classification: 26A24,44A05.

Introduction: Integral transform methods have been investigated to deal with various issues in the differential equations with starting or limit conditions. Kamal ,Mahgoub ,Laplace, Sumudu and Elzaki transforms are such run of the mill things. Among these, the Kamal transform strategy is an astonishing and basic instrument, and this expect a vocation to handle explicitly starting worth issues unaccompanied by first choosing a arrangement.

The method of integral transform is usually considered a valuable tool to deal with problems concerning integral equations. In this paper, we handle the problem by Kamal transform derivative demonstrated by Heaviside function. And this plays a role to solve precisely initial value problems without first definitive a general solution and non-homogeneous ordinary differential equations left out first solving the identical homogeneous.

The Kamal transforms of derived function have been looked into from multiple points of view to solve deferential equations. The foremost points are [1]

$$ƙ^*[ƛ'(\mathcal{T})] = \frac{1}{r}\mathfrak{f}(r) - ƛ(0)$$

$$ƙ^*[ƛ''(\mathcal{T})] = \frac{1}{r^2}\mathfrak{f}(r) - \frac{1}{r}ƛ(0) - ƛ'(0).$$

For Kamal transform of the first and second derivatives of $ƛ(\mathcal{T})$. In this article, we might want to propose the new methodology of $ƙ^*[ƛ'(\mathcal{T})]$ by modifying the decision capacity of differential structure in mix by segments. outcome is $ƙ^*\left[ƛ'(\mathcal{T})\right]$ can be spoken to by an infinite arrangement or Heaviside work.

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Fundamental records

On the off chance that $ƛ(\mathcal{T})$ is a capacity defined for all $\mathcal{T} \geq 0$, its Kamal transform of $ƛ(\mathcal{T})$ set up with $e^{-\frac{\mathcal{T}}{r}}$, $0\ to\ \infty$. It is an element of r , and is defined by $\mathfrak{f}(r)$; consequently

$$ƙ^*[ƛ(\mathcal{T})] = \mathfrak{f}(r) = \int_0^{\infty} ƛ(\mathcal{T})\, e^{-\frac{\mathcal{T}}{r}} d\mathcal{T}\,, \qquad \mathcal{T} \geq 0.$$

given the basic of $ƛ(\mathcal{T})$ exists. In the above condition, if the kernel be changed to $e^{-s\mathcal{T}} / \frac{1}{u} e^{\frac{-\mathcal{T}}{u}} / u e^{\frac{-\mathcal{T}}{u}}$. we call Laplace / Sumudu / Elzaki transform, individually.

A basis $ƛ(\mathcal{T})$ has a Kamal transform if it states the improvement curtailment

$$ƛ(\boldsymbol{\mathcal{T}}) \leq \mathfrak{W} e^{\frac{|\mathcal{T}|}{k_j}}$$

because every $\mathcal{T} \geq 0$ for constant $\mathfrak{W}$ with k.

Remark : The peruse can be perused progressively about the Kamal transform in [1]

Main Results

We should need to suggest $ƙ^*\left[ƛ'(\mathcal{T})\right]$can be spoken as an limitless arrangement of $\frac{1}{r^k}$ by evolving the possibility of capacity of differential structure in coordination by segment, and allot with the shown by Heaviside function of it.

Th. 1 The Kamal transform of the first derived basis of $ƛ(\mathcal{T})$ gratify

$$ƙ^*\{ƛ'\} = \sum_{k=1}^{n} r^k ƛ^k(0) + r^n ƙ^*\left(ƛ^{(n+1)}\right)$$

for $ƛ^k$ is the k -th derivative of a presented with basis $ƛ(\mathcal{T})$. As $n \to \infty$,

$$\mathscr{k}^*\{\mathfrak{z}'\} = \sum_{k=1}^{n} r^k \mathfrak{z}^k(0).$$

The overhead statement holds if $\mathfrak{z}(\mathcal{T})$ and $\mathfrak{z}'(\mathcal{T})$ are consistent for all $\mathcal{T} \geq 0$ and amuse the increase condition.

Proof: The announcement by the mathematical prelude.
For $k = 1$, by integration by segment,

$$\mathscr{k}^*\{\mathfrak{z}'\} = \int_0^\infty e^{-\frac{t}{r}} \mathfrak{z}'(\mathcal{T})d\mathcal{T}$$

$$= \left[-r\mathfrak{z}'(\mathcal{T})e^{-\frac{\mathcal{T}}{r}}\right]_0^\infty + r\int_0^\infty e^{-\frac{\mathcal{T}}{r}} \mathfrak{z}''(\mathcal{T})d\mathcal{T}$$
$$= r\mathfrak{z}'(0) + r\mathscr{k}^*\{\mathfrak{z}''\}$$

holds. Next, we guess that

$$\mathscr{k}^*\{\mathfrak{z}'\} = \sum_{k=1}^{m^*} r^k \mathfrak{z}^k(0) + r^{m^*}\mathscr{k}^*\left(\mathfrak{z}^{(m^*+1)}\right), \quad (1)$$

and show that $\mathscr{k}^*\{\mathfrak{z}'\}$ can be communicated by

$$\mathscr{k}^*\{\mathfrak{z}'\} = \textstyle\sum_{k=1}^{m^*+1} r^k \mathfrak{z}^k(0) + r^{m^*+1}\mathscr{k}^*\left(\mathfrak{z}^{(m^*+2)}\right).$$

In (1),

$$\mathscr{k}^*\{\mathfrak{z}^{(m^*+1)}\} = \textstyle\int_0^\infty e^{-\frac{\mathcal{T}}{r}} \mathfrak{z}^{(m^*+1)}(\mathcal{T})d\mathcal{T}$$

$$= \left[-re^{-\frac{\mathcal{T}}{r}}\mathfrak{z}^{(m^*+1)}\right]_0^\infty + r\textstyle\int_0^\infty e^{-\frac{\mathcal{T}}{r}} \mathfrak{z}^{(m^*+2)}(\mathcal{T})d\mathcal{T}$$

$$= r\,\mathfrak{z}^{(m^*+1)}(0) + r\,\mathscr{k}^*\{\mathfrak{z}^{m^*+2}\}.$$

Consequently, from (1),

$$\mathscr{k}^*\{\mathfrak{z}'\} = \textstyle\sum_{k=1}^{m^*} r^k \mathfrak{z}^{(k)}(0) + r^{m^*}\left[r\,\mathfrak{z}^{(m^*+1)}(o) + r\mathscr{k}^*\left(\mathfrak{z}^{(m^*+2)}\right)\right]$$

$$= \textstyle\sum_{k=1}^{m^*+1} r^k \mathfrak{z}^{(k)}(0) + r^{m^*+1}\mathscr{k}^*\left(\mathfrak{z}^{(m^*+2)}\right). \quad (A)$$

In such a way, if the Eq.(A) influence for k, it influence for $k+1$. Therefore, by mathematical prelude, the Eq.(A) is genuine for complete natural figure n.

Th. 2

$$\mathscr{k}^*\{\mathfrak{z}'\} = e^{-\frac{n}{r}}\mathfrak{z}(n) - \mathfrak{z}(0) + \tfrac{1}{r}\textstyle\int_0^n e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})d\mathcal{T} + \mathscr{k}^*[\mathfrak{z}'(\mathcal{T})\mathfrak{u}(\mathcal{T}-n)]$$

for complete n and $\mathfrak{u}$ is the unit step .

Proof. Using mathematical prelude. For $n = 1$,

$$\mathscr{k}^*\{\mathfrak{z}'\} = \int_0^\infty e^{-\frac{\mathcal{T}}{r}} \mathfrak{z}'(\mathcal{T})d\mathcal{T}$$

$$= \left[e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})\right]_0^1 + \frac{1}{r}\int_0^1 e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})d\mathcal{T} + \int_1^\infty e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}'(\mathcal{T})\,d\mathcal{T}$$

$$= \left[e^{-\frac{1}{r}}\mathfrak{z}(1) - \mathfrak{z}(0)\right] + \frac{1}{r}\int_0^1 e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})d\mathcal{T} + \mathscr{k}^*\left[\mathfrak{z}'(\mathcal{T})\mathfrak{u}(\mathcal{T}-1)\right].$$

Alongside, we accept that the equality influence if $n = k^{**}$ i.e.,

$$\mathscr{k}^*\{\mathfrak{z}'\} = \left[e^{-\frac{k^{**}}{r}}\mathfrak{z}(k^{**}) - \mathfrak{z}(0)\right] + \frac{1}{r}\int_0^{k^{**}} e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})d\mathcal{T} + \mathscr{k}^*\left[\mathfrak{z}'(\mathcal{T})\mathfrak{u}(\mathcal{T}-k^{**})\right]. \quad (2)$$

Give us a chance to demonstrate that

$$\mathscr{k}^*\{\mathfrak{z}'\} = \left[e^{-\frac{(k^{**}+1)}{r}}\mathfrak{z}(k^{**}+1) - \mathfrak{z}(0)\right] + \frac{1}{r}\int_0^{k^{**}+1} e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})d\mathcal{T} + \mathscr{k}^*\left[\mathfrak{z}'(\mathcal{T})\mathfrak{u}(\mathcal{T}-k^{**}-1)\right].$$

From (2),

$$\mathscr{k}^{**}\{\mathfrak{z}'\} = \left[e^{-\frac{k^{**}}{r}}\mathfrak{z}(k^{**}) - \mathfrak{z}(0)\right] + \frac{1}{r}\int_0^{k^{**}} e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})d\mathcal{T} + \int_{k^{**}}^\infty e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}'(\mathcal{T})\,d\mathcal{T}\,. \quad (3)$$

Here,

$$\int_{k^{**}}^\infty e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}'(\mathcal{T})d\mathcal{T} = \int_{k^{**}}^{k^{**}+1} e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}'(\mathcal{T})d\mathcal{T} + \int_{k.^{**}+1}^\infty e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}'(\mathcal{T})d\mathcal{T}$$

$$= \left[e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})\right]_{k^{**}}^{k^{**}+1} + \frac{1}{r}\int_{k^{**}}^{k^{**}+1} e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})d\mathcal{T} + \mathscr{k}^*[\mathfrak{z}'(\mathcal{T})\mathfrak{u}(\mathcal{T}-k^{**}-1)]$$

$$= \left[e^{-\frac{(k^{**}+1)}{r}}\mathfrak{z}(k^{**}+1) - e^{-\frac{k^{**}}{r}}\mathfrak{z}(k^{**})\right] + \frac{1}{r}\int_{k^{**}}^{k^{**}+1} e^{-\frac{\mathcal{T}}{r}}\mathfrak{z}(\mathcal{T})dt + \mathscr{k}^*[\mathfrak{z}'(\mathcal{T})\mathfrak{u}(\mathcal{T}-k^{**}-1)]. \quad (4)$$

Substituting (4) to (3),

$$\mathcal{k}^*\{\lambda\} = \left[e^{-\frac{k^{**}}{r}}\lambda(k^{**}) - \lambda(0)\right] + \frac{1}{r}\int_0^{k^{**}} e^{-\frac{\mathcal{T}}{r}}\lambda(\mathcal{T})d\mathcal{T}$$
$$+ e^{-\frac{(k^{**}+1)}{r}}\lambda(k^{**}+1) - e^{-\frac{k^{**}}{r}}\lambda(k^{**})$$
$$+ r\frac{1}{r}\int_{k^{**}}^{k^{**}+1} e^{-\frac{\mathcal{T}}{r}}\lambda(\mathcal{T})d\mathcal{T}$$
$$+ \mathcal{k}^*[\lambda'(\mathcal{T})\ u(\mathcal{T} - k^{**} - 1)]$$
$$= \left[e^{-\frac{(k^{**}+1)}{r}}\lambda(k^{**}+1) - \lambda(0)\right]$$
$$+ \frac{1}{r}\int_0^{k^{**}+1} e^{-\frac{\mathcal{T}}{r}}\lambda(\mathcal{T})d\mathcal{T}$$
$$+ \mathcal{k}^*[\lambda'(\mathcal{T})u(\mathcal{T} - k^{**} - 1)].$$

The legitimacy of the balance for complete natural figure n succeeds by mathematical prelude. Obviously Theorem 2 are

$$\mathcal{k}^*\{\lambda\} = e^{-\frac{n}{r}}\lambda(n) - \lambda(0) + \frac{1}{r}\int_0^n e^{-\frac{\mathcal{T}}{r}}\lambda(\mathcal{T})d\mathcal{T}$$

for $\mathcal{T} < n$. With the proposed thought, we can apply on other integral transforms.

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