KAMAL TRANSFORM IN CRYPTOGRAPHY WITH SANDIP'S METHOD

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Abstract:In present paper, authors have used Kamal transform of hyperbolic and algebraicfunctions Cryptography with Sandip's method. In Sandip's method two keys are provided that gives high security to the message. The applicability of Kamal transform with Sandip's method is shown by various examples.

Keywords:Mahgoub Transform, Kamal Transform, Cryptography, Sandip Method, Sandip transform

1. INTRODUCTION

World has accepted digitalization in all sectors like banking, digital payments, google account etc. The most widely used technique is Cryptography secure our data. Sandip M. Sonawane and S. B. Kiwne [7] used Sandip method with Laplace-Carson transform [8] for Cryptography. A. Chinde [1] uses Natural transform with hyperbolic function to write message in cipher text. G. Naga Laxmmi, et.al [9] gave Cryptography scheme with Laplace transform of exponential function. A. Hiwarekar [3-4] generalized the concept with hyperbolic function. The integral transform method is widely used in Engineering, many applications of Laplace transform was given by Debnath [2], Vasishta[13]. Sonawane and Kiwne [11] introduced Sandip transform and gave its properties with the help of H-function. Kamal transform and Double Kamal transform with their properties were given by Sonawane and Kiwane [11].

The main objective of this article is to use Kamal transform and inverse Kamaltransform to write message in cryptography. In the first part the definition and Sandip's Method is given and in second part, theorems and examples are shown.

2. KAMAL TRANSFORM:

The Kamal Transform [11] is defined for piecewise continuous and exponential order functions. We consider functions in the set A defined by:

$$A = \left\{ f : |f(t)| < Me^{\left(\frac{|t|}{\alpha_j}\right)}, t \in (-1)^j \times \right.$$

0,∞, j=1,2;M, α1,α2>0 (1)

The constant M must be finite number, α_1, α_2 may be finite or infinite. Let $f(t) \in A$then the Kamal transform is defined as,

$K[f(t)] = k(p) = p\int_0^\infty e^{-t} f(pt)dt,\ \ t \geq$ *0, α1<p<α2* (2)

And inverse Kamaltransform is,

$f(t) = \frac{1}{2i\pi}\int_{\gamma-i\infty}^{\gamma+i\infty} e^{pt}\, k\left(\frac{1}{p}\right)\, dp\ ;\ \gamma \geq 0$

(3)

The properties of Kamal transform are given below, Let $K[f(t)] \ = \ k(p)$

1. $K[af_1(t) + bf_2(t)] = aK[f_1(t)] + b[f_2(t)]$
2. $K[e^{at} f(t)] = k\left(\frac{p}{1-ap}\right)$
3. $K[tf(t)] = p^2 k'(p)$
4. $K\left[\int_0^t f(t)\, dt\right] = pk(p)$
5. Let $f_1(t) = \begin{cases} f(t-a), & if\ t \geq 0 \\ 0, & t < 0 \end{cases}$ then $K[f_1(t)] = e^{\frac{a}{p}} k(p)$
6. $K[f'(t)] = \frac{k(p)}{p} - f(0)$

3. Sandips Method

Consider the function$f(t) = (2j)!\, tcosht$, then we can write it in series expansion as,

$$f(t) = \sum_{j=0}^{\infty} t^{2j+1}$$

and its Kamal transform is,

$$K[f(t)] = \sum_{j=0}^{\infty}(2j+1)!\,p^{2j+2}$$

3.1 Procedure for Encryption

1. Consider alphabets A to Z with numbers 0 to A, 1 to B and so on 25 to Z and denote them as T_i^1.
2. Find T_i^2 using $T_i^1 = T_i^2(mod b_1)$ with $k_{1i} = \frac{T_i^1 - T_i^2}{b_1}$called key one, here $i = 1,2,3,...$

   Also find $T_i^3 = \frac{T_i^2}{10}$, so that we get numbers between 0 and 1.
3. Use these values as a coefficients in the series expansion of $f(t)$ and apply Kamaltransform to the series, we get new coefficients say T_i^4.
4. Find T_i^5 using $T_i^4 * 10 = T_i^5(mod b_2)$ with $k_{2i} = \frac{T_i^4 * 10 - T_i^5}{b_2}$ called key second, here$i = 1,2,3,...$
5. Finally, we get Encrypted message with two keys.

3.2 Procedure for Decryption

1. Using Encrypted massage find $T_i^{'1}$ and calculate $T_i^{'2} = \frac{T_i^{'1} + k_{2i} * b_2}{10}$, using key second k_{2i}, $i = 1,2,3,...$
2. Use these values as a coefficients in the series expansion of $K[f(t)]$ and apply inverse Kamal transform to the series, we get new coefficients say $T_i^{'3}$.
3. Find $T_i^{'4} = T_i^{'3} * 10$ and with help of key one obtain $T_i^{'5} = T_i^{'4} + b_1 k_{2i}$, $i = 1,2,3,...$
4. Finally we get original message with $T_i^{'5} = T_i^5$, $i = 1,2,3,...$

4. Theorem and Examples

Theorem 4.1 The message given using plain text string in terms of T_i,$i = 1,2,3,...$such that T_i are the coefficients of the series expansion of $Tf(t) = T(2j)!\,tcosht$

can be converted in to $T_i^{'}$ using Laplace-Carson transform and Sandip's Method for encryption, where,

$T_i^{'} = g_i * 10 + k_{2i} * b_2$, $i = 1,2,3,...$

And $g_i = s_i * i!$, $s_i = \frac{T_i - k_{1i} * b_1}{10}$, $i = 1,2,3,...$

with key one $k_{1i} = \frac{s_i - T_i}{b_1}$ and key second $k_{2i} = \frac{T_i^{'} - g_i * 10}{b_2}$, $i = 1,2,3,...$

Theorem 4.2 The message given using cipher text string in terms of $T_i^{'}$, $i = 1,2,3,...$such that $F_i$are the coefficients of the series expansion of

$$K[f(t)] = \sum_{j=1}^{\infty}(2j + 1)!\,p^{2j+1}$$

can be converted in to $F_i^{'}$ using Inverse Laplace-Carson transform and Sandip's Methodfor decryption, where,

can be converted in to $F_i^{'}$ using Inverse Laplace-Carson transform and Sandip's Methodfor decryption, where,

$$T_i = s_i^{'} - k_{1i} * b_1 , i = 1,2,3,...$$

And $s_i^{'} = \frac{g_i^{'}}{i!} * 10, T_i^{'} = \frac{g_i^{'} + k_{2i} * b_2}{10}$, $i = 1,2,3,...$

Example 4.1Encryption: Let the given message in plain text string be SONY and use Sandip's method with $b_1 = 10, b_2 = 26$. Given message can written as,

$$18\ 14\ 13\ 24$$

Let's find T_1 and key one k_1 using (mod 10) we get,

$T_1 = 8\ 4\ 3\ 4$ with $k_1 = 1\ 1\ 1\ 2$

Use these values in the series expansion of $f(t)$ by dividing 10, and $a = 1$ we get,

$$Tf(t) = 0.8\mathrm{t} + 0.4\mathrm{t}^3 + 0.3\mathrm{t}^5 + 0.4\mathrm{t}^7$$

Taking Kamal transform, we get

$$K[Tf(t)] = 0.8p^2 + 2.4p^4 + 36p^6 + 2016p^8$$

Adjusting the numbers, multiplying them by 10 and taking $(mod\ 26)$, we get new numbers with key second,

$T_i^{'} = 8\ \ 24\ \ 22\ \ 10$ with $k_2 = 0\ \ 0\ \ 13\ \ 775$

The cipher text is $ICWK$.

We send one key by mobile, second key by Email and cipher text in public.

Decryption:

Take the cipher text $ICWK$ with key second $k_2 = 0\ 0\ 13\ 775, b_2 = 26$, we get

$T_1^{'} = 8\ 24\ 22\ 10$ and $T_2^{'} = 8\ 24\ 360\ 20160$

Use $T_3^{'} = \frac{T_2^{'}}{10}$as coefficients in series expansion of Kamal transform of $K\ [T(2j)!\,tcosht]$,

we write

$$K[Tf(t)] = 0.8p^2 + 2.4p^4 + 360pa^6 + 358160p^8$$

Taking Inverse Laplace-Carson transform, we may get

$$Tf(t) = 0.8t + 2.4\frac{t^3}{3!} + 36\frac{t^5}{5!} + 2016\frac{t^7}{7!}$$

Adjusting the numbers, multiplying them by 10 and using key one $k_1 = 1\ 1\ 1\ 2$, we get numbers with mod 10,
$F_1 = 18\ 14\ 13\ 24$ with plain text $SONY$

Conclusion

The method used in this article for Cryptography scheme is can be applied in banking sector for verifying password of online account or any online transaction. As it generates two keys so not easy to decode for the third person.

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