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A SURVEY ON APPLICATION OF LAPLACE TRANSFORM IN CRYPTOGRAPHY

PROF.(MS). SHUBHANGI GURAV.
A.G. Patil Institute of Technology Solapur, Solapur University, Department of Mathematics (General Science Engineering)
Email:shubhangigurav28@gmail.com

MS.DHANASHRI ALURE.
A.G. Patil Institute of Technology, Solapur University, Department of Computer Engineering.
Email:shivanialure@gmail.com

ABSTRACT

The opening years of the twenty –first century have been remarkable ones for mathematical sciences. Mathematical sciences play an essential role in the physical & biological sciences, engineering, medicine, economics, finance & social science. [The mathematical science have become integral to many emerging industries]The mathematical sciences includes for more than numbers they deal with geometrical figures, logical patterns networks, randomness & Predictions from incomplete data, various transforms etc; & the mathematical sciences are part of almost every aspect of everyday life.

Laplace transform is a powerful tool which is used in various areas of engineering and science. This paper deals with the application of Laplace transform in cryptography. Cryptology is the science and art of secret communications. Cryptography is the set method used to ensure the secrecy and authenticity of messages.

Cryptology plays vital role in the provision of logical barriers to attacks on information systems security. In this paper we can take a review of applications of Laplace transform in cryptography.

KEYWORDS: Laplace transform, Cryptography, Plain text, Cipher text, inverse Laplace transform ,Encryption, Decryption.

INTRODUCTION

Cryptography has been defined As, The 'umbrella word used to Describe the entire field of secret Communications.'

Cryptography Has been concerned with Protecting the secrecy of information Cryptography involves mathematical Transformation of transformation. Nowadays applicative mathematics Is plays an important role to make

Society technically advanced. In this Paper Laplace transform is used for Cryptography .In [1], they encrypt A string by using series of cosh2t and Its Laplace transform. In this paper use hyperbolic sine function.

DEFINITIONS

ENCRYPTION- encryption is the process Converting the intelligible message (Plain text) to its unintelligible form (The cipertext).

DECRYPTION:-decryption is the process of converting the unintelligible message back to its intelligible Form the original under stable message.

CIPHER TEXT - is a method to transform a plain text into Something that is difficult to understand.

LAPLACE TRANSFORM:-If and (t) is function Defined on $(0,\infty)$,then the Laplace transform of f(t) is defined as

$$L\{f(t)\} = \int_0^\infty e^{-st} f(t)dt = \emptyset(S)$$

provided that a function f(t) should satisfies the following condition

1) f(t) is continuous
2) limit as $t \to \infty$ $\{e^{-at} f(t)\}$ is finite, then the Laplace transform of f(t)
   i.e. $\int_0^\infty e^{-at} f(t)dt$ exists for s>a

Inverse of Laplace transform – If L{ f(t)} is function in S given as

$$L\{f(t)\} = \emptyset(S)$$

then inverse laplace transform is defined as follows

$$L^{-1}[\emptyset(S)] = f(t)$$

Laplace transform of some standard function

$$L\{\frac{K}{t^n}\} = K.L[t^n] = K.\frac{n!}{s^{n+1}}$$

$$L^{-1}[\frac{1}{s^n}] = \frac{t^{n-1}}{(n-1)!}$$

Standard expansion of sinhat

$$\text{sinhat} = at + \frac{a^3t^3}{3!} + \frac{a^5t^5}{5!} + \frac{a^7t^7}{7!} + \cdots + \frac{a^nt^n}{n!}$$

$$= \sum_{n=1}^{\infty} \frac{(at)^n}{n!}$$

MAIN RESULT

We consider standard expansion

$$\text{tsinhat} = at + \frac{a^3t^3}{3!} + \frac{a^5t^5}{5!} + \frac{a^7t^7}{7!} + \cdots + \frac{a^nt^n}{n!}$$

$=\sum_{n=1}^{\infty}\frac{(at)^n}{n!}=\sum_{i=0}^{\infty}\frac{(a)^{2i-1}t^{2i}}{(2i-1)!}$

where aϵN is a constant with N is the set of natural number. we allocated 0 to A and 1 to B then Z will be 25.Let given message plain text string be ' PASSWORD '. It is equivalent to

15 0 18 18 22 14 17 3

we assume that

$G_0=15$ $G_1=0$ $G_2=18$
$G_3=18$ $G_4=22$ $G_5=18$
$G_6=17$ $G_7=14$

Let us consider

f(t)=Gtsinh2t=

$t\{G_0 2t+G_1\frac{2^3t^3}{3!}+G_2\frac{2^5t^5}{5!}+G_3\frac{2^7t^7}{7!}+G_4\frac{2^9t^9}{9!}+G_5\frac{2^{11}t^{11}}{11!}+G_6\frac{2^{13}t^{13}}{13!}+G_7\frac{2^{15}t^{15}}{15!}$

$=t\{15*2*t+0*\frac{2^3t^3}{3!}+18*\frac{2^5t^5}{5!}+18*\frac{2^7t^7}{7!}+22*\frac{2^9t^9}{9!}+14*\frac{2^{11}t^{11}}{11!}+17*\frac{2^{13}t^{13}}{13!}+14*\frac{2^{15}t^{15}}{15!}\}$

$=\sum_{i=0}^{\infty}\frac{Gi(2)^{2i-1}t^{2i}}{(2i-1)!}$

Taking Laplace transform on both sides we have

$L\{f(t)\}=L\{G\ tsinh2t\}=$

$L\{15*2*t^2+0*\frac{2^3t^4}{3!}+18*\frac{2^5t^6}{5!}+18*\frac{2^7t^8}{7!}+22*\frac{2^9t^{10}}{9!}+14*\frac{2^{11}t^{12}}{11!}+17*\frac{2^{13}t^{14}}{13!}+14*\frac{2^{15}t^{16}}{15!}\}$

$=\frac{60}{s^3}+\frac{0}{s^5}+\frac{414720}{s^7}+\frac{92897280}{s^9}+\frac{40874803200}{s^{11}}+\frac{13733933880000}{s^{13}}+\frac{121407975500000000}{s^{15}}+\frac{9598371707000000000}{s^{17}}$

to mod 26 the given plain text strings gets converts to cipher text string

8 0 20 8 18 22 24 24

Hence the given message string 'PASSWORD' get converted to 'IAUISWYY' with key k_i for i=0,1,2,3...as

2 0 15950 3572972 157210769 528228226200 36916814260000000

$G_i'=q_i-26k_i$ by [1]

DECRYPTION:

We assume that the received message string be ' IAUISWYY 'which is equivalent to

8 0 20 8 18 22 24 24

Assuming

$G_0'=8$ $G_1'=0$ $G_2'=20$
$G_3'=8$ $G_4'=18$ $G_5'=22$
$G_6'=24$ $G_7'=24$ for $n\geq 9$

the given key k_i i=0,1,2,3...as

2 0 15950 3572972 157210769 528228226200 36916814260000000

Here we have q_i for i=0,1,2,3,...8 are respectively given by

60 0 414720 92897280 40874803200 13733933880000 121407975500000000 9598371707000000000

Using the formula

$q_i=26k_i+G_i'$ by [1]

We consider

$G\{-\frac{d}{ds}\}\frac{1}{(s^2-2^2)}=\sum_{i=0}^{\infty}\frac{k_i}{s^{2i+1}}=\frac{60}{s^3}+\frac{0}{s^5}+\frac{414720}{s^7}+\frac{92897280}{s^9}+\frac{40874803200}{s^{11}}+\frac{13733933880000}{s^{13}}+\frac{1214079755\ 00000000}{s^{15}}+\frac{9598371707000000000}{s^{17}}$.

Taking inverse Laplace transform we get

$G\ tsinh2t=15*2*t^2+0*\frac{2^3t^4}{3!}+18*\frac{2^5t^6}{5!}+18*\frac{2^7t^8}{7!}+22*\frac{2^9t^{10}}{9!}+14*\frac{2^{11}t^{12}}{11!}+17*\frac{2^{13}t^{14}}{13!}+14*\frac{2^{15}t^{16}}{15!}$.

Hence we have

$G_0=15$ $G_1=0$ $G_2=18$
$G_3=18$ $G_4=22$ $G_5=18$
$G_6=17$ $G_7=14$ for $n\geq 9$.

which is equivalent to 'PASSWORD'.

CONCLUSION

In this paper we have studied in detail the concept of cryptography using Laplace transform. It is an important and analytical tool that used for various applications. This survey provides the researchers and students to know about how Laplace transform is used in cryptography

APPLICATIONS OF LAPLACE TRANSFORM

- Laplace transform is used to solve Boundary value problems,ordinary differential equation, Used in linear nonlinear difference equation ,steady state solutions ,cryptography.
- Also Laplace transform has huge applications in electric circuit theory, it has complex applications in power system as well.
- The Laplace transform can be applied to solve the
- switching transient phenomenon in the series or parallel RL, RC or RLC circuits
- Laplace transform is a very effective mathematical tool to simplify very complex problems in the area of stability and control.

- Laplace transform has a lot of application in Physics and other sciences.

APPLICATIONS OF CRYPTOGRAPHY

1) Mobile security
2) Network security
3) Information security
4) Electronic mail and firewall

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