**SYSTEM OF FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS BY USING COMPLEX EFG TRANSFORM**

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**Abstract:**

Recently Kuffi, Karaaslan and sadkhan developed EFG integral transform. We apply EFG transform for solving first order differential equation’s system.

Key words: Integral transform, System of differential equation, Ordinary differential equation.

1. **Introduction:**

Integral transforms are very much useful in differential equations and hence play important role. Now a day’s lot of researchers are interested and engaged in developing new integral transform and using those in different types of differential, integral as well as integro-diffrential equations and their systems.

Recently Kushare transform [2] and Soham transform [3] are introduced by Kushare, Khakale and Patil. Kuffi et al introduced Complex EFG transformation [1] (2022). Patil [4, 5, 6, 7, 8, 9] used various integral transforms for solving various systems of differential equations.

In this chapter we use EFG transform for solving system of first order differential equations.

1. **Priliminary:**

In this section we state some definitions, properties and formulae of complex EFG transform which are required to solve the system of first order ordinary differential equations .

**Definition [1]** : For the function of exponential order in set B defined as

B ={f(t) : there exist m, L1, L2 > 0} ,

where, , m is finite for a particular function in the set B while L1 and L2 may be finite or infinite; we can define Complex EFG transform.

We denote the complex EFG transform by{} and define it as

(f(t))= dt = f (iu) t 0, L1  s(u)L2

**Table 1: Some basic functions and their Complex EFG integral transform .**

|  |  |  |
| --- | --- | --- |
| Sr. No. | Function | EFG Transform |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 | sin(at) |  |
| 8 | cos(at) |  |
| 9 | sinh(at) |  |
| 10 | cosh(at) |  |

**P****roperties of EFG transform:[1]**

**Property 1:** If then

=

=

**Property:2. Shifting property for the EFG transform**

If then; , where is a real constant number .

**Theorem**: Transform of derivatives [1]

Let F(u) be the Complex EFG transform of the f(t) then = - f(0) + is(u). F(iu)

**Linearity Property:** If f(t) and g(t) are two functions then,

where α and β are arbitrary constant

1. **Applications for system of equation**

In this section we use Complex EFG transform to solve following first order differential equation’s system.

Example:1 Consider the system of differential equations.

(2)

With the given initial condition and

By using EFG transform to equation (1) and equation (2),

Using initial conditions,

1. e.

Multiplying equation (3) by is(u) and equation (4) by 1 and subtracting we get,

{y}= (since

Now applying inverse complex EFG transform we obtain

From equation (3)

Solving these two equations simultaneously,

(since )

By using inverse complex EFG transform, we obtain

Required solution is and .

Example:2 Consider system of differential equation

With the given initial condition x(0)=0 & y(0)=1

By using EFG transform

}

We solve equations (3) and (4),

Solving these two equations simultaneously,

[

By using inverse complex EFG transform we get,

From equation 4

= [

By using inverse EFG transform,

It is the required solution.

**CONCLUSION:** We used Complex EFG integral transform to solve the first order system of ordinary differential equations successfully. Answers obtained by using Complex EFG integral transform are same as obtained by another integral transform methods.

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