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# Response of Electrical Networks with Delta Potential via Mohand Transform

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***Abstract* - The electrical network circuits with delta potential are generally solved by adopting Laplace transform method. The paper inquires the electrical network circuits with delta potential by Mohand transform technique. The purpose of paper is to prove the applicability of Mohand transform to analyze electrical network circuits with delta potential.**

***Keywords:*** Mohand Transform, Electrical Network Circuit, Delta Potential.

## I. Introduction

Mohand Transform has been applied in solving boundary value problems in most of the science and engineering disciplines [1]. It also comes out to be very effective tool to analyze the electrical network circuits with delta potential. The general differential equations for analyzing the electrical circuits are generally solved by adopting Elzaki Transform method or Laplace transform method or matrix method or convolution method or calculus method [2, 3, 4, 5, 6, 7, 8, 9, 10, 11,]. In this paper, we present Mohand transform technique to analyze electrical network circuits with delta potential.

## II. Basic Definitions

### 2.1 Mohand Transform

If the function $\hbar(y)$, $y \geq 0$ is having an exponential order and is a piecewise continuous function on any interval, then the Mohand transform of$\hbar(y)$ is given by

$$M\{\hbar(y)\} = \bar{\hbar}(p) = p^2 \int_0^\infty e^{-py}\, \hbar(y)dy.$$

The Mohand Transform [1] of some of the functions are given by

- $M\{y^n\} = n!/p^{n-1}, where n = 0,1,2,..$
- $M\{e^{ay}\} = \frac{p^2}{p-a},$
- $M\{sin ay\} = \frac{ap^2}{p^2+a^2},$
- $M\{cos ay\} = \frac{p^3}{p^2+a^2},$
- $M\{sinh ay\} = \frac{ap^2}{p^2-a^2},$
- $M\{cosh ay\} = \frac{p^3}{p^2+a^2},$
- $M\{\delta(t)\} = p^2$

### 2.2 Inverse Mohand Transform

The Inverse Mohand Transform [1] of some of the functions are given by

- $M^{-1}\{\frac{1}{p^n}\} = \frac{y^{n+1}}{(n+1)!}, n = 0, 1, 2, 3, 4 \ldots$
- $M^{-1}\{\frac{p^2}{p-a}\} = e^{ay}$
- $M^{-1}\{\frac{p^2}{p^2+a^2}\} = \frac{1}{a}\sin ay$
- $M^{-1}\{\frac{p^3}{p^2+a^2}\} = \cos ay$
- $M^{-1}\{\frac{p^2}{p^2-a^2}\} = \frac{1}{a}\sin hay$
- $M^{-1}\{\frac{p^3}{p^2+a^2}\} = \cos hay$

### 2.3 Mohand Transform of Derivatives

The Mohand Transform [1] of some of the Derivatives of h(y) are given by

- $M\{h'(y)\} = pM\{h(y)\} - p^2 h(0)$
  $or M\{\hbar'(y)\} = p\bar{\hbar}(p) - p^2\hbar(0),$
- $M\{\hbar''(y)\} = p^2\bar{\hbar}(p) - p^3\hbar(0) - p^2\hbar'(0), and so on$

### Application I: RLC Circuit with Delta Potential of Unit Strength

$$L\ddot{Q} + R\dot{Q} + \frac{Q}{C} = \delta(t)$$

$$Where L = 1 \text{ henry}, R = 6 \text{ ohm}, C = \frac{1}{9}\, farad,$$

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$$and Q(0) = Q'(0) = 0$$

$$\ddot{Q} + 6\dot{Q} + 9Q = \delta(t)$$

Applying Mohand Transform, we have

$$M\{\ddot{Q}\} + 6M\{\dot{Q}\} + 9M\{Q\} = p^2$$

*or*

$$p^2\bar{Q}(p) - p^3Q(0) - p^2Q'(0) + 6p\bar{Q}(p)$$
$$-6p^2Q(0) + 9\bar{Q}(p) = p^2$$

*or*

$$p^2\bar{Q}(p) + 6p\bar{Q}(p) + 9\bar{Q}(p) = p^2$$

*or*

$$\bar{Q}(p) = \frac{p^2}{(9 + 6p + p^2)}$$

*or*

$$\bar{Q}(p) = \frac{p^2}{(3 + p)^2}$$

*Hence*

$$Q = M^{-1}\left\{\frac{p^2}{(3 + p)^2}\right\}$$

*or*

$$Q = te^{-3t}$$

$$L\ddot{Q} + R\dot{Q} = \delta(t)$$

**Application II: RL Circuit with Delta Potential of Unit Strength**

$$Where L = 1\text{ henry}, R = 6\text{ ohm}$$
$$and Q(0) = Q'(0) = 0$$

$$\ddot{Q} + 6\dot{Q} = \delta(t)$$

Applying Mohand Transform, we have

$$M\{\ddot{Q}\} + 6M\{\dot{Q}\} = p^2$$

*or*

$$p^2\bar{Q}(p) - p^3Q(0) - p^2Q'(0) + 6p\bar{Q}(p)$$
$$-6p^2Q(0) = p^2$$

*or*

$$p^2\bar{Q}(p) + 6p\bar{Q}(p) = p^2$$

*or*

$$\bar{Q}(p) = \frac{p^2}{(6p + p^2)}$$

*or*

$$\bar{Q}(p) = \frac{p}{6} - \frac{p^2}{6(6 + p)}$$

*Hence*

$$Q = M^{-1}\{1/6 - 6/(6 + p)\}$$

*or*

$$Q = \frac{1}{6}[1 - e^{-6t}]$$

**Application III: RC Circuit with Delta Potential of Unit Strength**

$$R\dot{Q} + \frac{Q}{C} = \delta(t)$$

$$Where R = 6\text{ ohm}, C = \frac{1}{9}\ farad\,,$$
$$and Q(0) = 0$$

$$6\dot{Q} + 9Q = \delta(t)$$

Applying Mohand Transform, we have

$$6M\{\dot{Q}\} + 9M\{Q\} = p^2$$

*or*

$$6p\bar{Q}(p)$$
$$-6p^2Q(0) + 9\bar{Q}(p) = p^2$$

*or*

$$6p\bar{Q}(p) + 9\bar{Q}(p) = p^2$$

*or*

$$\bar{Q}(p) = \frac{p^2}{(9 + 6p)}$$

*or*

$$\bar{Q}(p) = \frac{p^2}{6(\frac{3}{2} + p)}$$

*Hence*

$$Q = M^{-1}\left\{\frac{p^2}{6(\frac{3}{2} + p)}\right\}$$

*or*

$$Q = \frac{1}{6}e^{-1.5t}$$

## III. Conclusion

In this paper, we have analyzed the electrical network circuits with delta potential by Mohand Transform technique. It may be finished that the technique is accomplished in analyzing the electrical network circuits with delta potential.

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