CHAPTER 1

INTRODUCTION

We know that the flow of electric current I in a simple series circuit with inductance L, resistance R and capacitance C is given by

$$L\,\frac{d}{dt}\,I(t) + R\,I(t) + \frac{1}{C}\,Q(t) = E(t) \tag{1.1}$$

where t is the time , Q is the total charge and E is the impressed voltage .

Since $I(t) = \frac{d}{dt}\,Q(t)$ then we also obtain the second order equation

$$L\,\frac{d^2}{dt^2}\,Q(t) + R\,\frac{d}{dt}\,Q(t) + \frac{1}{C}\,Q(t) = E(t). \tag{1.2}$$

It is not difficult to find the solution $Q(t)$ of the equation and the charge $Q(t)$ is always an ordinary periodic function which is continuous for $0 \leq t < T$.

But in this research , we study the case $E(t)$ is replaced by the electromotive force

$$\sum_{k=o}^{m} c_k \delta_T^{(k)}(t)$$

where $\delta_T(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT)$ with its derivatives is the periodic impulse function and c_k is a constant and $\delta_T^{(0)} = \delta_T$.Now we consider the equation

$$L\,\frac{d^2}{dt^2}\,Q(t) + R\,\frac{d}{dt}\,Q(t) + \frac{1}{C}\,Q(t) = \sum_{k=o}^{m} c_k \delta_T^{(k)}(t). \tag{1.3}$$

It is found that the solution of the equation (1.3) need not be an ordinary periodic function, it may be the periodic distribution that is the solution in the space $\mathcal{P}'_T$ of periodic distribution whose period T. All type of those solutions depending on the values of m are as the following cases.

(i) If $m \geq 2$ then there exists the solution of equation (1.3) that belong to the space $\mathcal{P}'_T$.

(ii) If $0 \leq m < 2$ then all solutions are ordinary periodic functions that are continuous for $0 \leq t < T$ and it also follows that if $m \geq 1$ the current $I(t)$

is not an ordinary periodic function but it is the periodic distribution in the space $\mathcal{P}'_T$, that mean the current $I(t)$ is periodic but it occurs impulse and its derivatives in every period T.

If $m = 0$ then the current $I(t)$ is continuous for $0 \leq t < T$ that means the current $I(t)$ flows continuously for the time $0 \leq t < T$.

In solving the solution of the equation (1.3) that is the charge $Q(t)$, we use the method of T-convolution of $e^{\alpha t}\delta_T^{(k)}$ with some periodic distribution to apply and also the finite Fourier transform is needed .