

## **PAPER # 8**

- **TITLE:**

**Charging and Discharging  $RC_\alpha$  Circuit Under Riemann-Liouville and Caputo Fractional Derivatives.**

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- **ABSTRACT:**

The effect of non-zero initial condition on the time domain response of fractional-order systems using Caputo (C) and Riemann-Liouville (RL) fractional definition are investigated.

By studying the general solution of state space representation of fractional order Linear Time Invariant system (LTI) by using RL and C fractional operator, it was found that both gave the same output in two cases:

Case 1: zero initial condition.

Case 2: steady state.

As an example, analytical formulas were derived for step and square wave responses of fractional order  $RC_\alpha$  circuit under RL and C. But both gave different responses in case of non-zero initial conditions. By taking  $RC_\alpha$  circuit

as example and studying the time response for unit step input voltage and also for square wave input voltage, the output voltage across the fractional capacitor follows the input voltage more rapidly as  $\alpha$  tends to zero.