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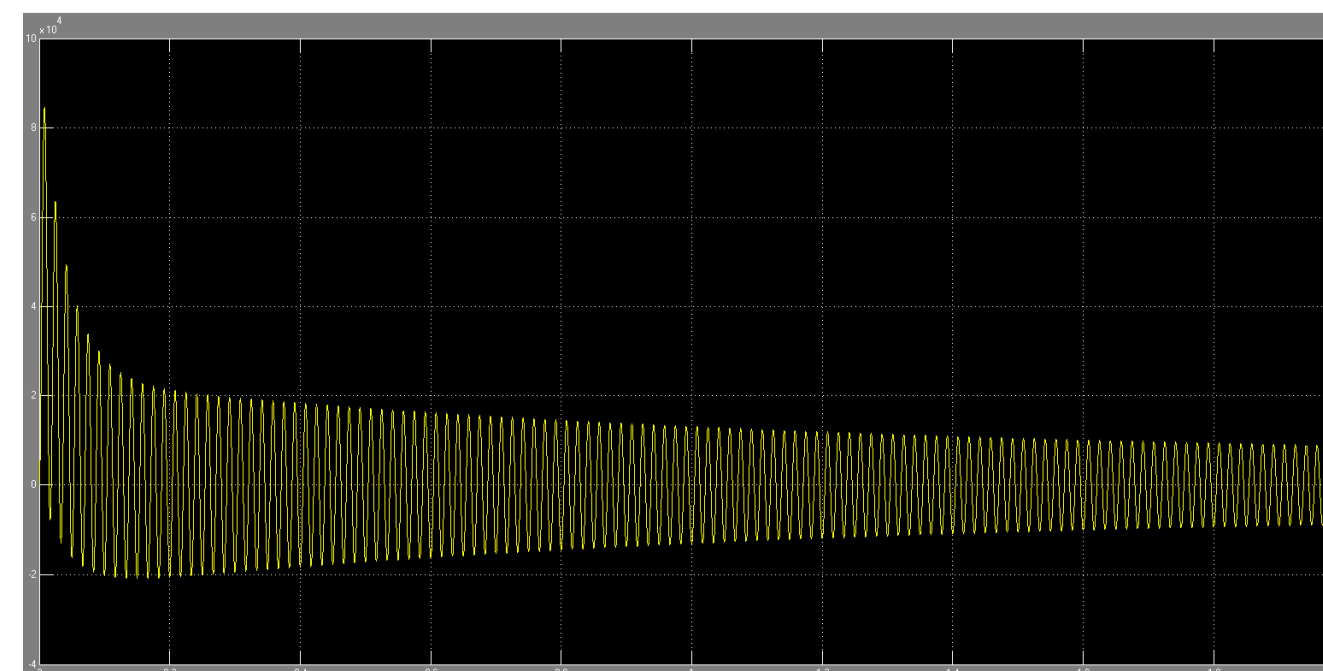
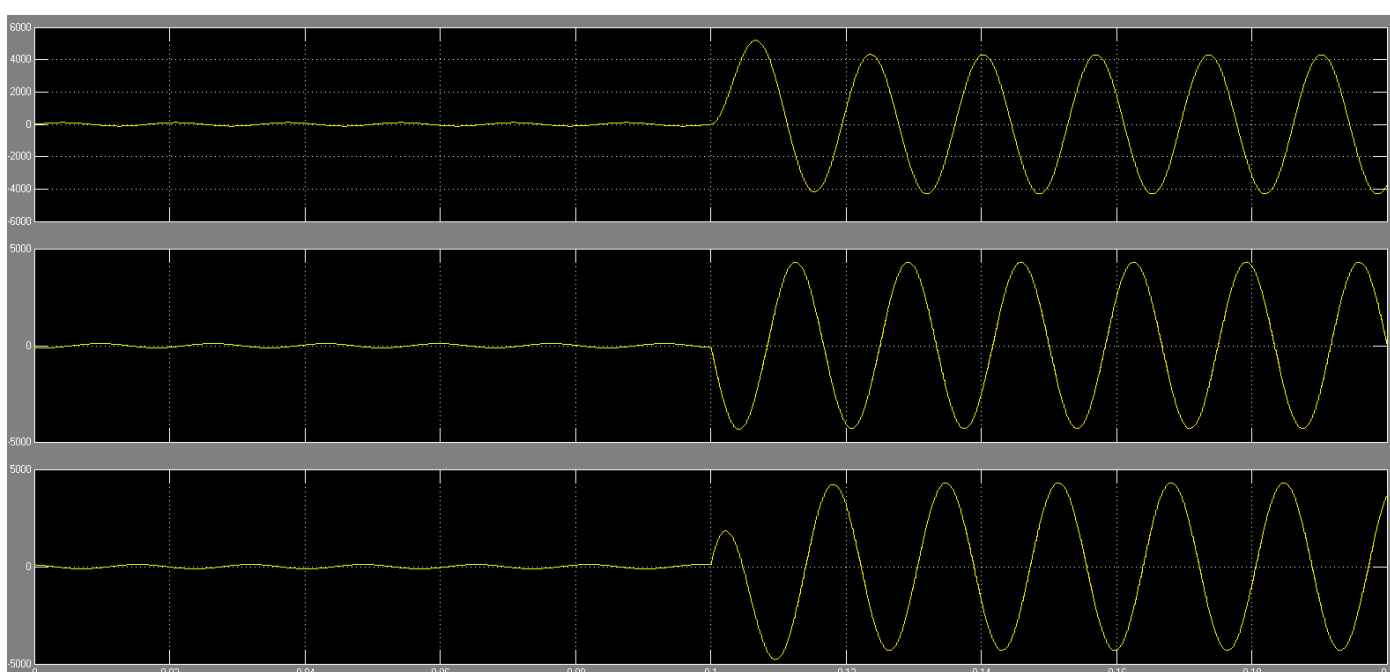
## Background

- **Faults**
  - Many different kinds
  - Fault current most important parameter
- **Hardware Test Bed**
  - Used to simulate power systems
  - Utilizes AC-to-DC power converters
  - Can currently simulate open-circuit faults



## Application/Desired Outcome

- **Complete Fault Circuit Models**
  - Standard Models make assumptions
  - Example: all other currents are zero
  - Use phasor-domain
    - Only works for one frequency or finite set of frequencies
    - Must be periodic
- Complete time-domain waveforms with transient effects
- Main Application: to see fault effect on power system before fault is cleared
  - Sub-transient and transient states
- **Desired Waveforms:**



## Results

- **Characteristic Equations:**
  - Example Line-to-Ground fault
    - Before:  $i_A = \frac{V_A - V_a}{Z_A + Z_a}$
    - After:
    - $i_F = i_A - i_a$

$$\left\{ \left\{ i_A \rightarrow \frac{-V_a Z_f + V_A (Z_a + Z_f)}{Z_A Z_f + Z_a (Z_A + Z_f)}, i_a \rightarrow \frac{V_A Z_f - V_a (Z_A + Z_f)}{Z_A Z_f + Z_a (Z_A + Z_f)} \right\} \right\}$$

- Incomplete model
  - Transient effect not obtained
- Dynamic Transfer function needed
  - Errors encountered
  - Not easily programmed in C

