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| **IV Characteristics – Time domain** |
| **Resistors** –  | **Inductors** –  | **Capacitors** –  |
| **Continuity conditions** |
|  |  |  |

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| **IV Characteristics – Laplace domain** |
|  |  |  |
| **Resistors** –  | **Inductors** –  | **Capacitors** –  |
| ***Impedance, Z [Ω], properties have the same characteristics as resistance*** ***Impedances in series add,***  ***Impedances in parallel have an inverse relationship,***  |
| Initial Value Theorem  | Final Value Theorem  |

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| --- |
| First order circuits Differential equation:  , with solution   represents a source function or nth derivative of the source function, with appropriate coefficients  represents the homogeneous/transient part of the solution For first order circuits, the homogeneous solution always takes the form    represents the particular/forced part of the solution. The particular solution is always the same type of function as the source. τ is the time constant For RC circuits,  For RL circuits,  |
| Second order circuits Differential equation:  , with solution  s-domain   represents the homogeneous/transient part of the solution The form of the homogeneous solution depends on the damping  represents the particular/forced part of the solution. The particular solution is always the same type of function as the source.  represents a source function or nth derivative of the source function  represents the Laplace transform of the function f(t) |
| **Overdamped** **(α > ωo)** |  |  |
|  |  |
| **Critically Damped** **(α = ωo)** |  | from the differential equation |
|  |  |
| **Underdamped** **(α < ωo)** |  | from the differential equation |
|  |  |
| RLC series circuit   | RLC parallel circuit   |

***Partial Fraction Expansion***

***Simple Real Poles:***



***Real, Equal Poles – Double Pole:***

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***Complex Conjugate Poles***

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