1.2 THE LUMPED CIRCUIT ABSTRACTION

1. Capped a set of lumped elements that obey the lumped matter discipline using ideal wires to form an assembly that performs a specific function results in the lumped circuit abstraction.

1.3 THE LUMPED MATTER DISCIPLINE

a. Once we adhere to the lumped matter discipline, we can make several simplifications in our circuit analysis and work with the lumped circuit abstraction. Thus, the lumped matter discipline provides the foundation for the lumped circuit abstraction, and is the fundamental mechanism by which we are able to move from the domain of physics to the domain of electrical engineering.

1. Choose lumped element boundaries such that the rate of change of magnetic flux linked with any closed loop outside an element must be zero for all time.

∂B/∂t = 0

* Voltage is the work involved to move a particle with a unit of charge from one point to another against the e- field force.
* Voltage value is independent of path taken – this can be true if there is no time-varying magnetic flux outside the element.

1. Choose lumped element boundaries so that there is no total time varying charge within the element for all time. In other words, choose element boundaries such that

∂q/∂t = 0

* We can define a unique value for current is there is not charge build up or depletion.
* Both 1 and 2 require that magnetic flux outside the elemenet and charge within the element must be 0 at all times. It also is required that the magnetic flux and electric field are 0 at all times. No field (e- or magnetic) can exert over each other. This allows elements to be independently analyzed: 🡪 V=IR

1. Operate in the regime in which signal time scales of interest are much larger than the propagation delay of electromagnetic waves across the lumped elements.