Systematic Bond Graph models generation for Electrical Systems

What follows is the recommended systematic procedure for modeling electrical systems starting with the physical system and generating the bond graph.

Step 1. Recognize the type of elements that make up the system. Here the inductors are the (I) elements which store kinetic energy, the capacitors are (C) elements for storing potential energy and the resistors are the (R) elements that dissipate energy.

Fig 1 Electrical Circuit Schematic

Step 2. Use a 1 junction to represent each distinct current of the system. (1 junctions represent the summation of voltages)

Fig 2. Place a 1 junction for each current.

Step 3. Attach the physical elements that experience the distinct currents. This time also with power directed into each element.

Fig 3 Attach physical elements to 1 junctions.

Step 4. Represent the difference of currents with 0 junctions. Keep in mind the sign conventions. These “relative” currents are also represented with 1 junctions.

Fig 4. Draw 0 junctions for the current differences.
Step 5  Attach the elements that experience those relative currents. These are represented by 1 junction also. Assign power into those elements. Complete power flow connections if necessary. (Do not worry about causality marks at this point).

Fig 21. Attach elements to the current differences

Fig 5  Enter this model in CAMPG

Fig 6. Complete CAMPG Bondgraph model with causality marks, power flow and automatically assigned bond numbers.