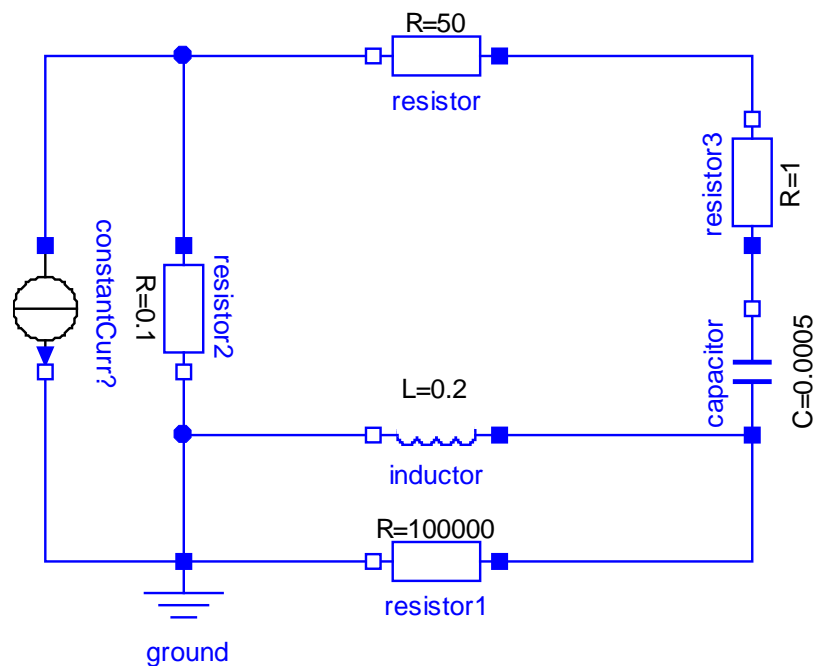Dr. Dirk Zimmer

Virtual Physics

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Exercise 5: Tearing Algebraic Loops within an electric circuit

On top, you see a simple RLC-Circuit where with a few extra resistors that make the ideal components more realistic. Your task is to derive the state-space form of this circuit.

Task A: Set up the model equations

Use the component equations and Kirchhoff's laws to set up the circuit equations. You may simplify the equations by merging alias variables for current or voltage-potential.

Task B: Identify suitable tearing variables

First perform forward-causalization as much as possible. Then proceed with the causalization by directly choosing appropriate tearing variables. Causalize the remaining set of equations and identify the residual equations. Justify your selection of tearing variables.