

Modeling Parameter Sensitivities via Equation-based Algorithmic Differentiation Techniques

The ADMSL.Electrical.Analog Library

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Figure 1 presents a standard electrical circuit example, the ChuaCircuit model from the standard Modelica library `Modelica.Electrical.Analog.Example`. By simulating this example, parameter sensitivities are additionally evaluated. The curves in the upper part and the lower part correspond to the parameter sensitivities of

- the current at all components (i.e. $L.i$, $R_o.i$, $G.i$, $C1.i$, $C2.i$, $Nr.i$, $Gr.i$) w.r.t. the inductance parameter $L.L$ and
- the voltage at the Inductor L w.r.t. all parameters (i.e. $L.L$, $R_o.R$, $G.G$, $C2.C$, etc.) respectively

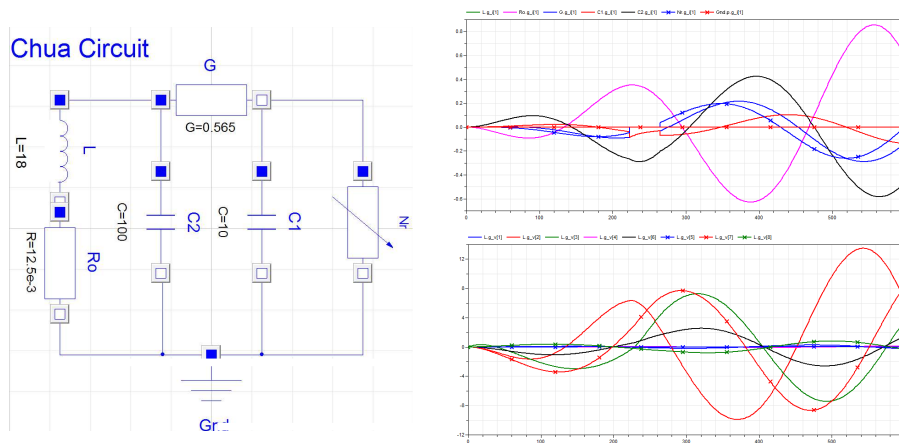


Figure 1: The Chua Circuit standard example and simulation of parameter sensitivities

This example is within the ADMSL library [1] (Algorithmically Differentiated Modelica Standard Library). The ADMSL library is an Algorithmic Differentiation (AD) version of the standard library `Modelica.Electrical.Analog.Basic`. It has an identical structure to the original standard library, but it enhances the components with additional declaration and equations for describing parameter sensitivities.

The algorithmically differentiated library ADMSL serves as an illustrative example for applying novel equation-based AD techniques on Modelica libraries. It illustrates the basic steps required to systematically transform a Modelica library to another library that additionally describes models parameter sensitivities. The produced library remains with the same structure and the underlying models keep the same interface and outlook.

References

- [1] A. Elsheikh. The ADMSL library. <https://github.com/AIT-CES-LAB/ADMSL>.