Formal Abstraction and Verification of Analog Circuits

**Model Abstraction**

- **VERA**: State space sampler
- **ELSA**: Abstraction core

**Abstracted Model**

- Hybrid automaton generated in Verilog-A, Matlab or SystemC-AMS syntax
- The model is simulated or a reachability analysis is performed in the reduced state space $S_r$. Via a back transformation, all nodal voltages and currents can be obtained in the original state space $S_o$.

**Extensions**

- **Model With Abstraction Variations**
  - Instead of describing the system behavior via a matrix $A$, formed by taking the mean of the eigenvalues, a matrix zonotope or interval matrix is used to hull all the eigenvalues of a location for the Matlab (Cora) models.

- **Model With Parameter Variations**
  - For the SystemC-AMS models a similar approach is possible using the AADD library [1]. The models are thus extended to model uncertainties.

- **Compositional Automaton**
  - As the generated models are pin compatible, they are suitable for compositional abstraction. This can be done by abstracting the sub-circuits of a large netlist, followed by linking them in a compositional manner to abstract the whole circuit.

- **Model Checking and Reachability Analysis**
  - A reachability analysis can be conducted with the HA, and a (currently) post simulation model checking can be performed.

**Publications**