

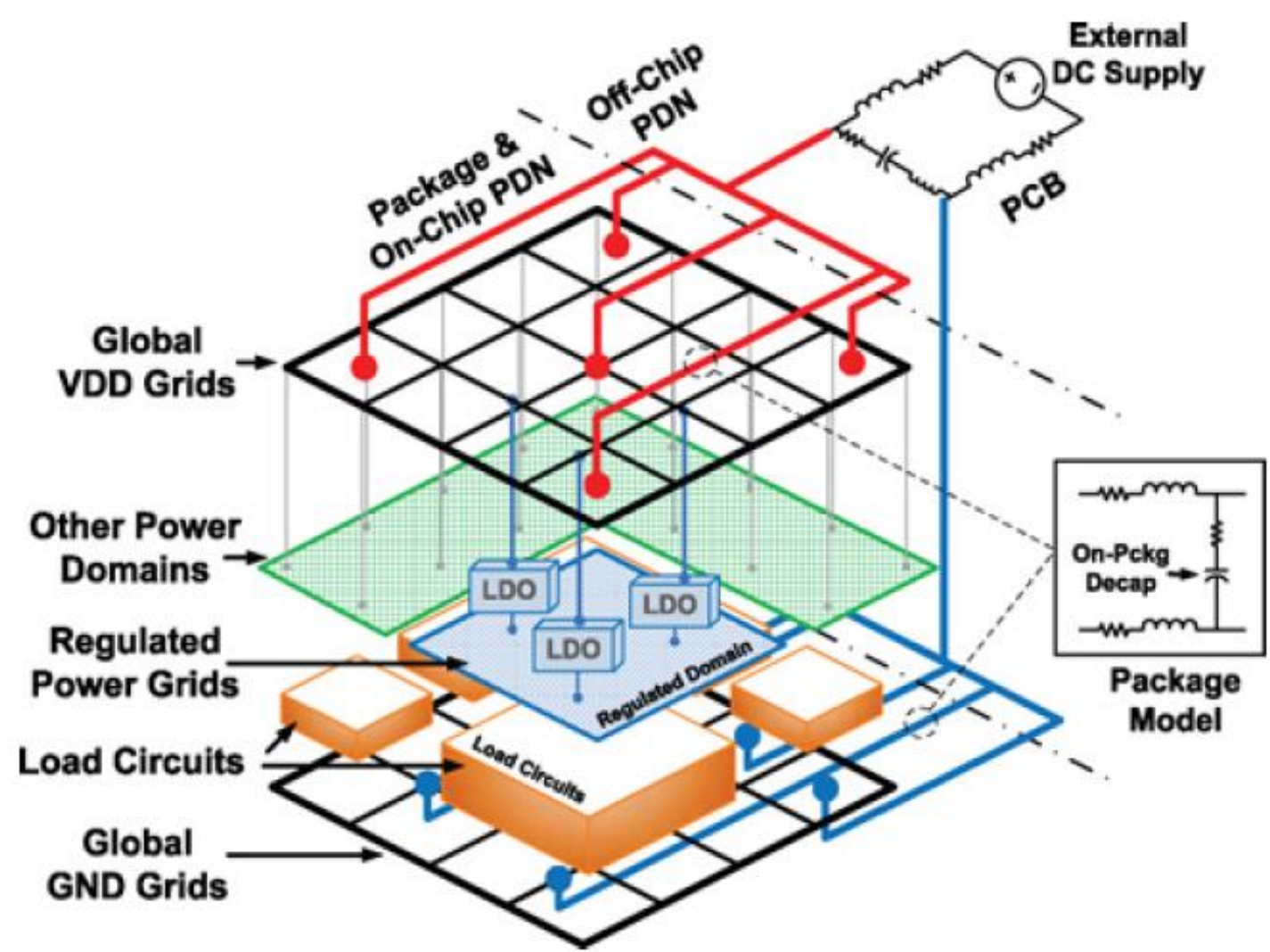
Enabling Fast System-level Simulation and Optimization via Parameterized Macromodeling

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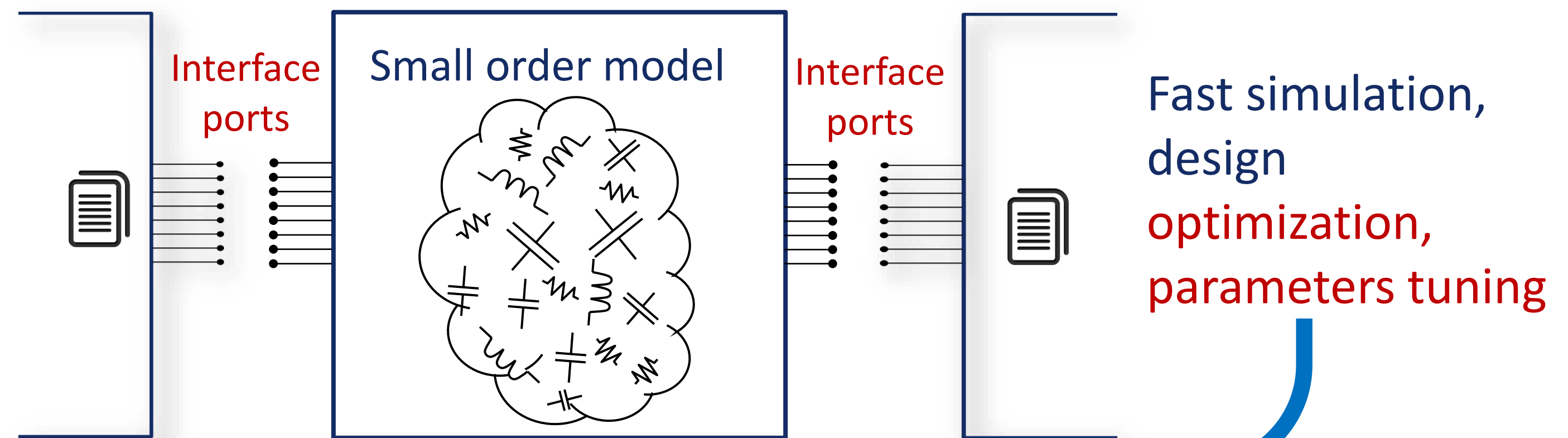
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System-level Simulations and Optimization

Design and optimization of large-scale electronic systems require simulating repeatedly large interconnected blocks. **Macromodels enable fast simulations** by providing accurate and reduced order descriptions for each subsystem.



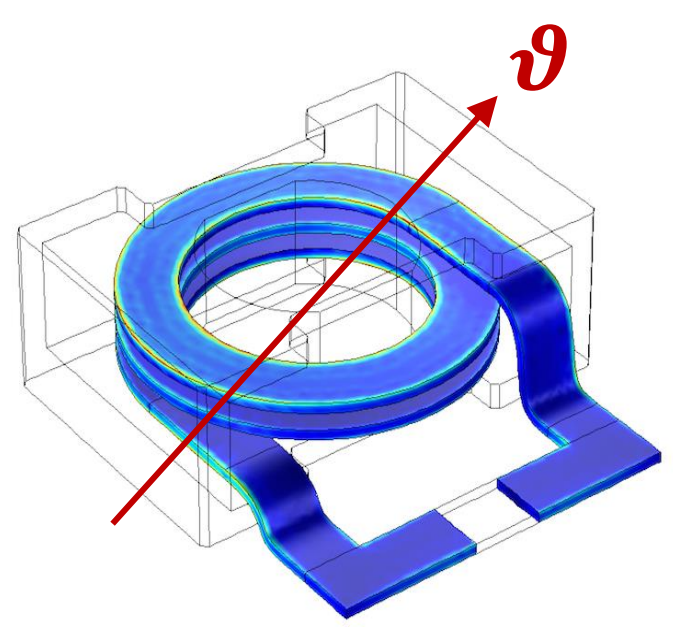
System partitioning, AC analysis, and macromodeling



Time consuming !

When some design parameters are changed to perform optimization, the macromodels must be recomputed from scratch.

Fully Parameterized Rational Models

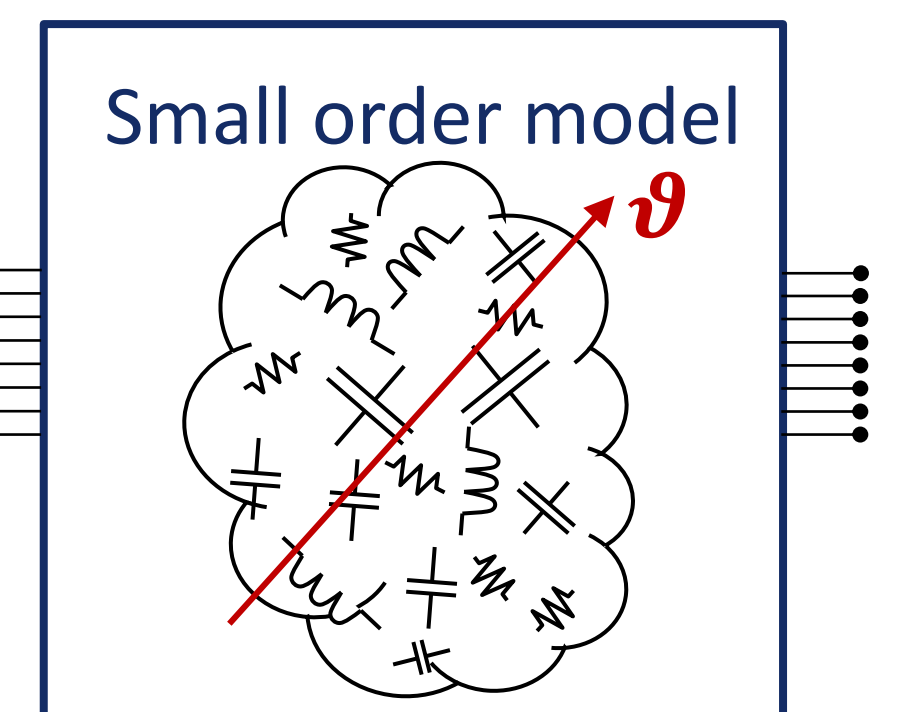


Gather **Multiple AC responses** only once

Parameterized "Vector Fitting" model structure

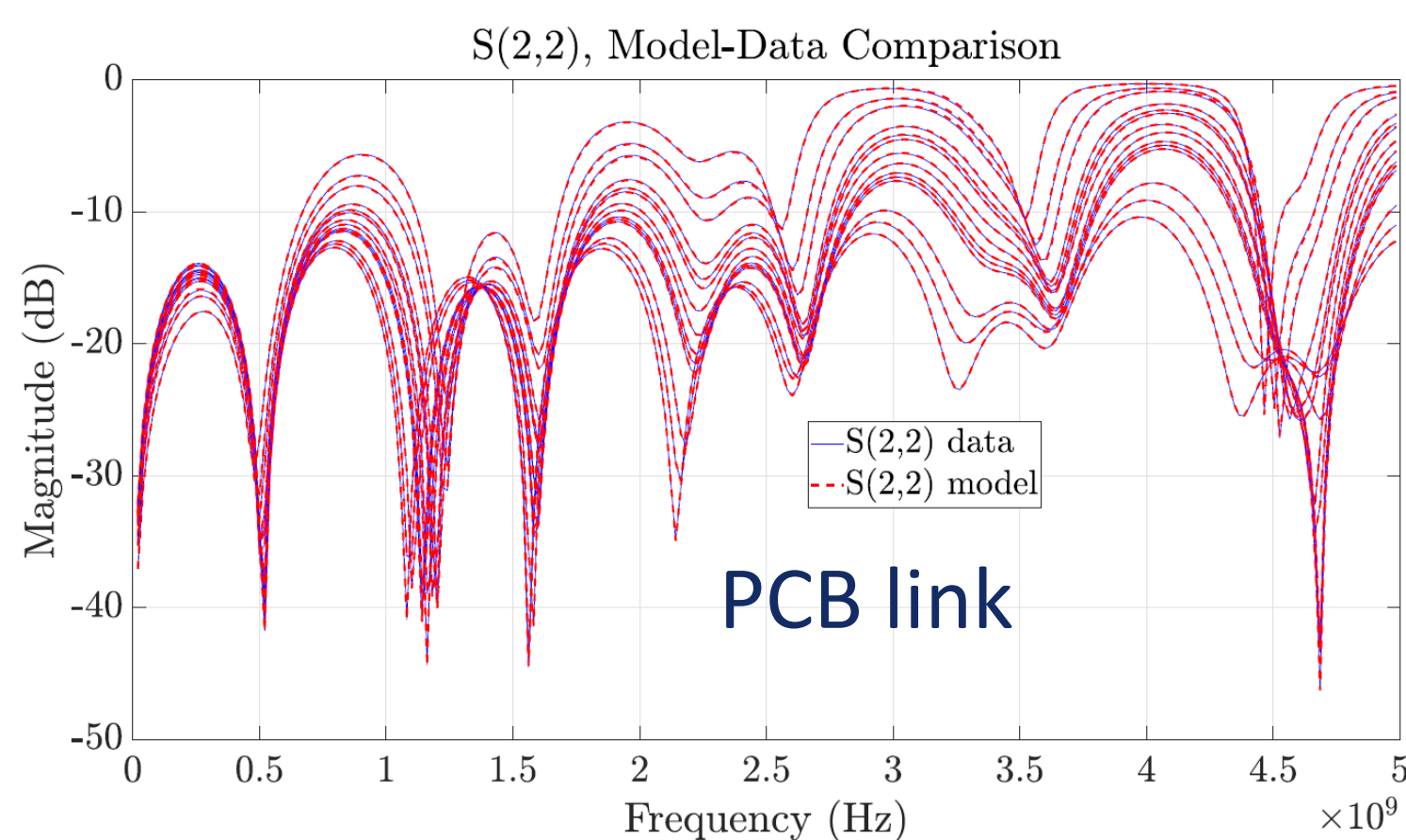
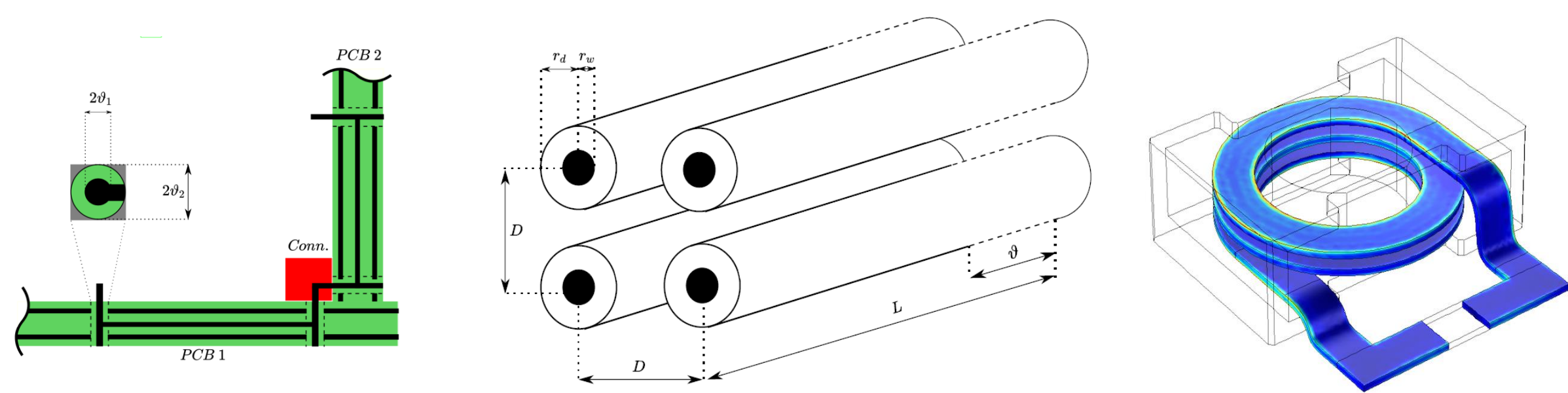
$$H(s, \vartheta) = \frac{N(s, \vartheta)}{D(s, \vartheta)} = \frac{\sum_n \sum_\ell R_{n,\ell} b_{\ell,\bar{\ell}}(\vartheta) \varphi_n(s)}{\sum_n \sum_\ell r_{n,\ell} b_{\ell,\bar{\ell}}(\vartheta) \varphi_n(s)}$$

Accurate, stable, passive model

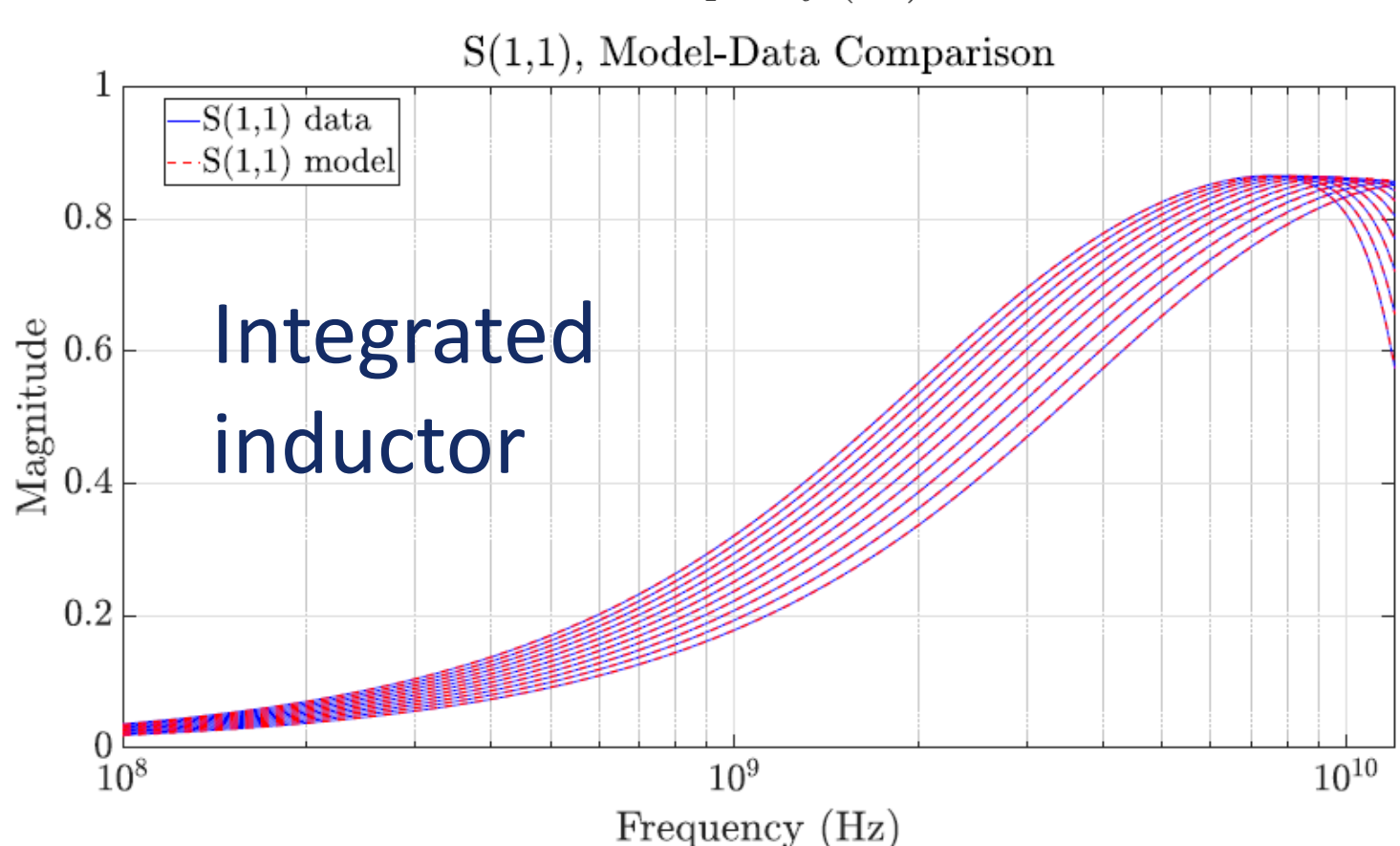


Recent theoretical results → formal **proof of stability and passivity, $\forall \vartheta$**

Passive Components



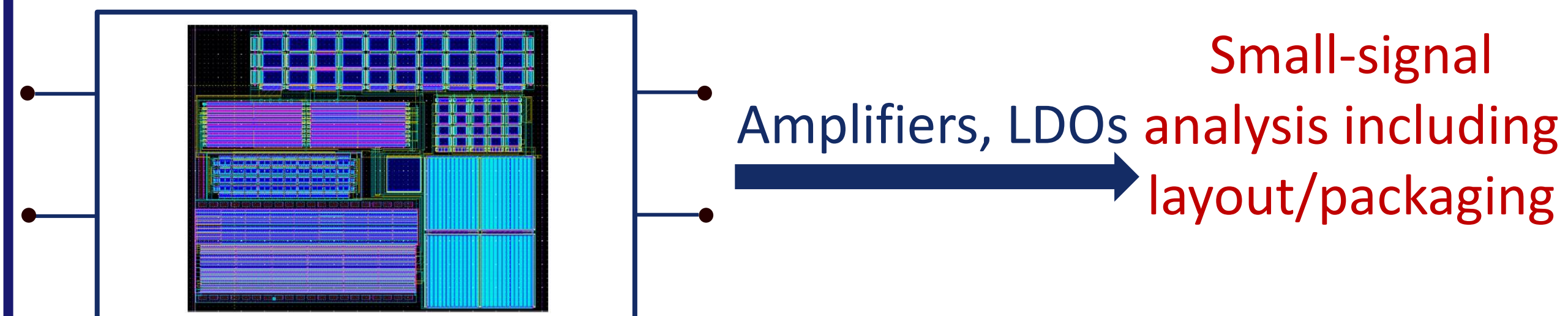
Model represents very accurately the dependence on both **frequency and design parameters**.



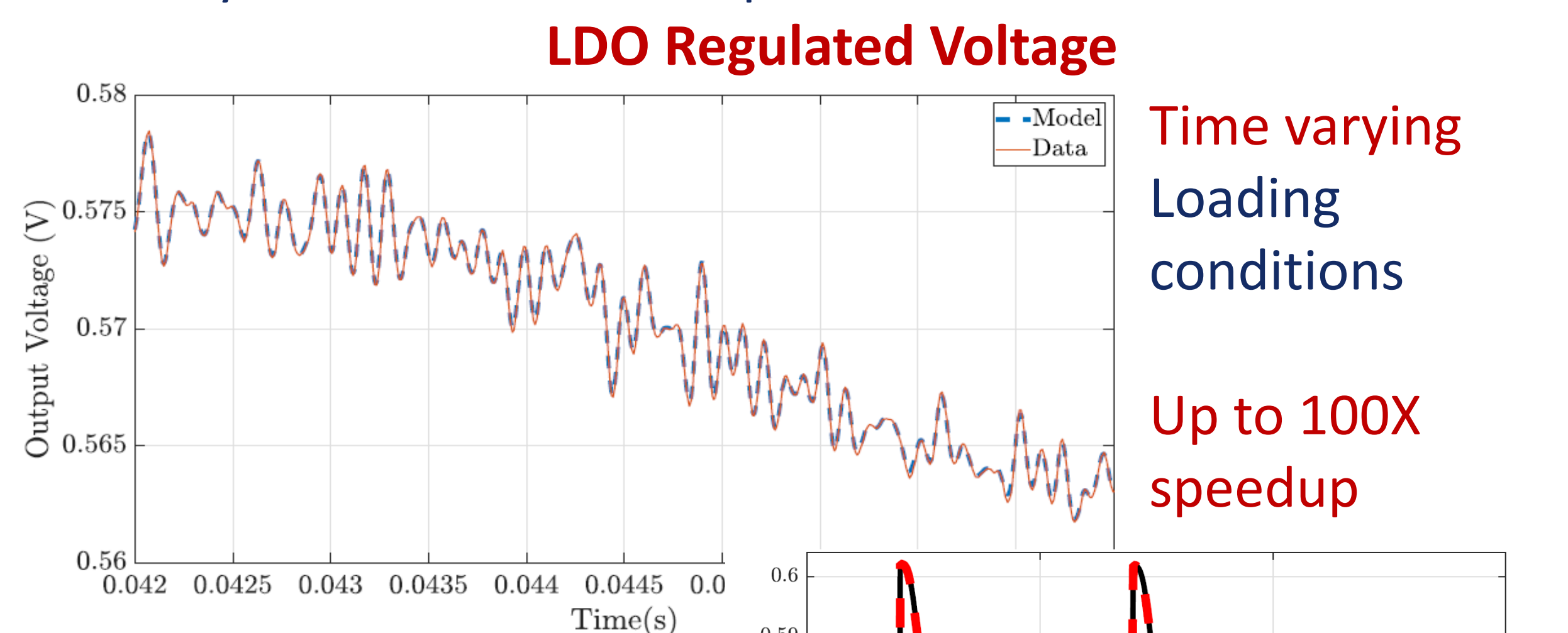
Models are compact and **structurally passive** for each parameter configuration

Fully deterministic modeling procedure

Analog Circuit Blocks

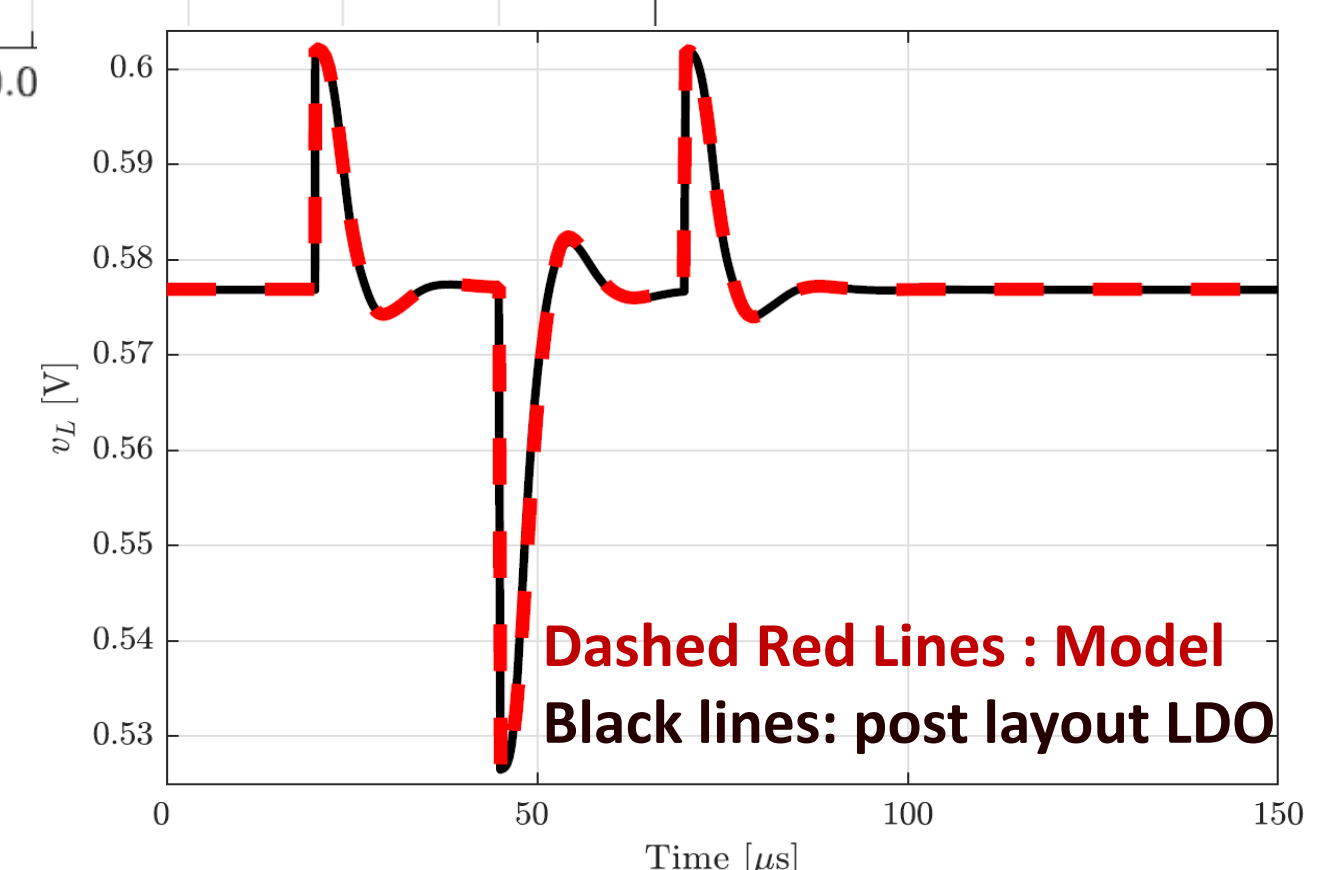


Post-layout LDO: netlist compression from 30MB to few kB



Uncertain but constant Loading conditions

Up to 675X speed-up



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