



Center for High-Frequency Technologies and Applications

# ***Metamodeling of Complex Systems***

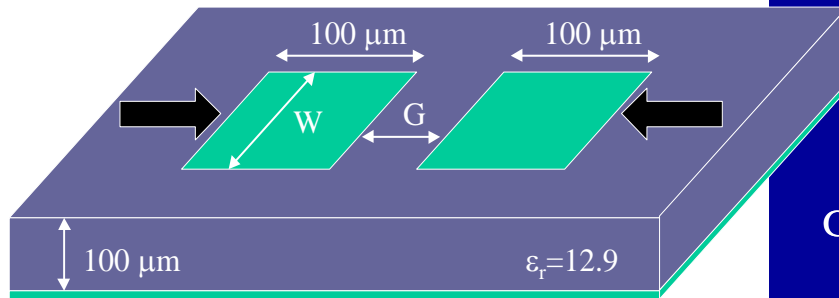
Dr. ir. Dries Vande Ginste  
Technology Developer

- Multi-port broadband macromodeling to obtain SPICE compatible models for high-speed and microwave circuits and for seamless integration of EM tools in circuit level system simulations
- Model order reduction techniques reducing very large dynamic systems to smaller ones with similar input-output behavior (either differential equation based or pole/zero based)
- Scalable metamodels for multiport circuits and their automatic generation for computationally expensive problems

→ *Models valid for all kinds of dynamic systems (mechanical, chemical, ...)*

SUrrrogate MOdeling Toolbox “SUMO”: → <http://www.sumo.intec.UGent.be>

## Example: gap coupling

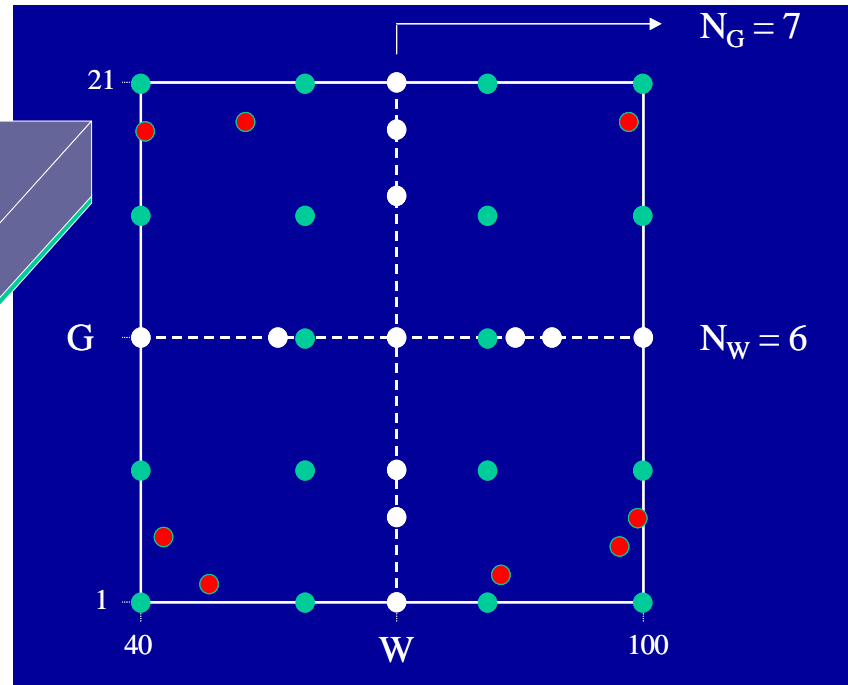


**W:** 40 μm → 100 μm

**G:** 1 μm → 21 μm

**freq.:** 0 → 60 GHz

**accuracy:** -60 dB



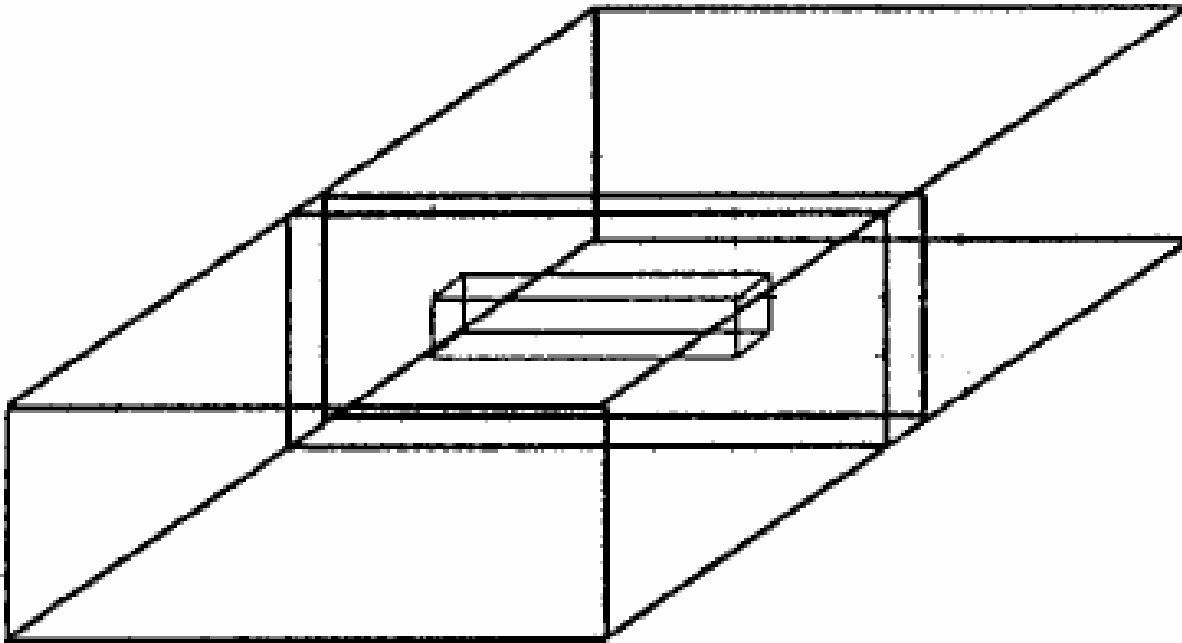
Very limited dataset!

$$S(f, W, G) = \sum_{i=0}^5 \sum_{j=0}^3 C_{ij}(f) G^i W^j + C_{04}(f) W^4 + C_{14}(f) G W^4 + C_{60}(f) G^6$$

Example: bivariate model of rectangular waveguide (highly dynamic system)

*Frequency : [12 GHz – 18 GHz]*

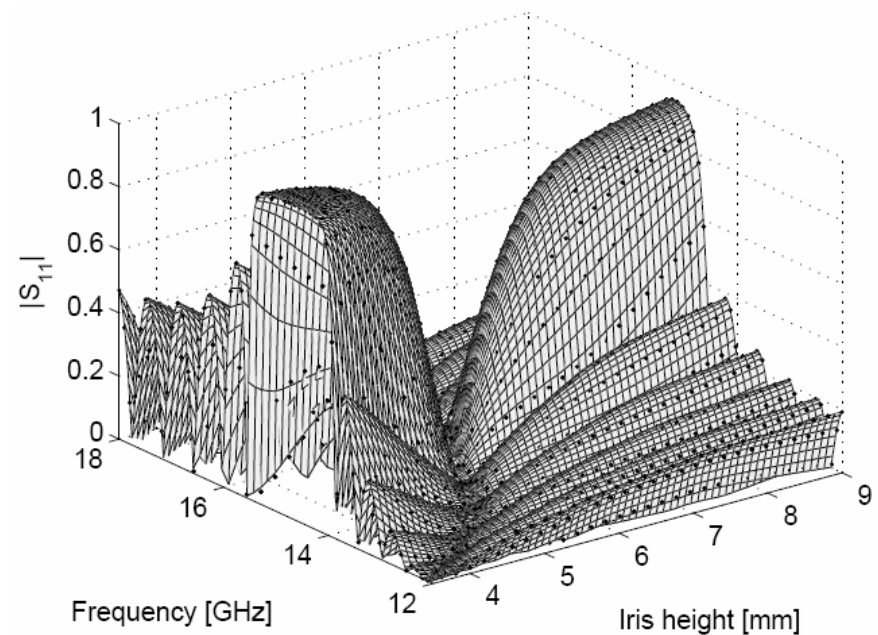
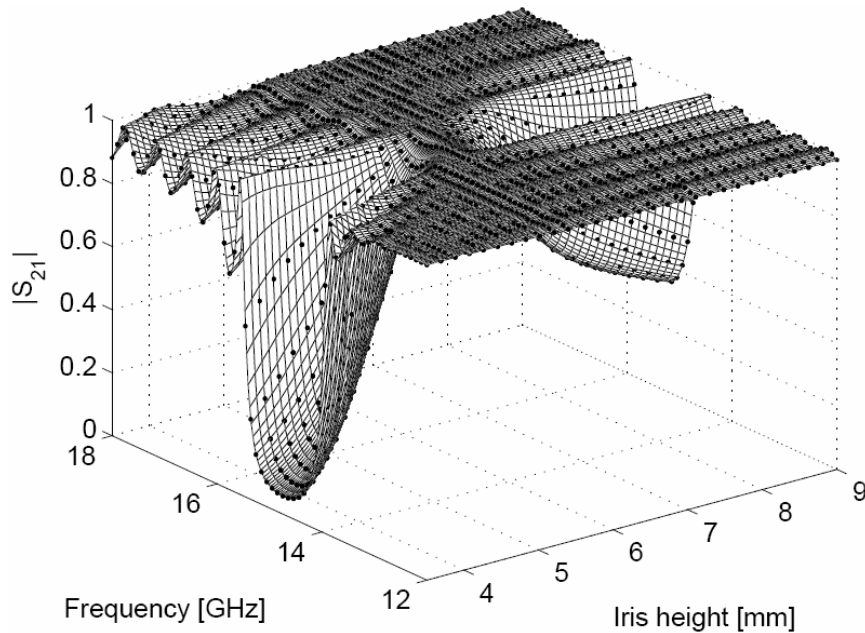
*Iris height  $h$  : [3,5 mm – 9 mm]*



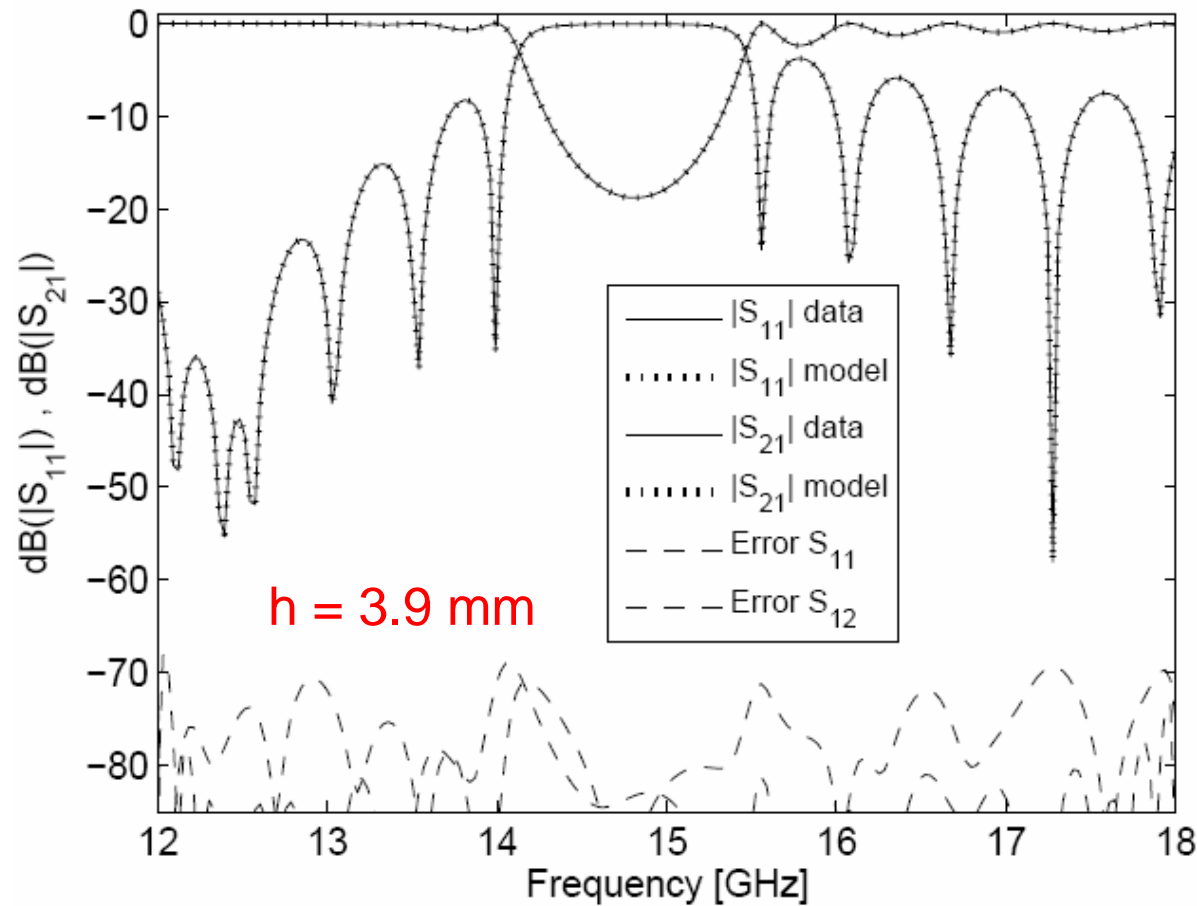
Example: bivariate model of rectangular waveguide (highly dynamic system)

*Frequency : [12 GHz – 18 GHz]*

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Example: bivariate model of rectangular waveguide (highly dynamic system)



Dr. ir. Dries Vande Ginste  
Technology Developer

Center for High-Frequency Technologies and Applications (CHiTA)  
Dept. of Information Technology (INTEC) - Ghent University  
Sint-Pietersnieuwstraat 41  
B-9000 Gent  
Belgium

Phone: +32 9 264 33 54

Fax: + 32 9 264 99 69

Email: [Dries.Vande.Ginste@intec.UGent.be](mailto:Dries.Vande.Ginste@intec.UGent.be)

Website: <http://www.CHiTA.be/>