

Das Fachgebiet **Bauelemente der Höchstfrequenzelektronik (BHE)**  
in der Abteilung EIT der Fakultät Ingenieurwissenschaften  
der Universität Duisburg-Essen bietet folgende



## Abschlussarbeit (M.Sc.)

### High-Density Signal Routing at RF Frequencies for Heterogenous Integration

This master thesis is done in collaboration with Bosch, the leading supplier of MEMS-based systems-on-chip, which are ubiquitously present in a magnitude of applications ranging from automobiles to mobile phones. High-frequency, radio-frequency, and millimetre-waves and their respective transmission lines play an important role for data transmission, measurement signal propagation and sensing applications.

The primary issue of designing an impedance-matched transmission line architecture within integrated circuits and micro sensors, with high-power handling capability, is the low thickness of the isolation and metallization layers [1]. Secondly, there are no well-suited simulation models available at the transition frequencies between lumped and distributed element models, and the available metallization thickness (significantly smaller than the skin depth) results in high RF losses, requiring numerical modeling [2].

Your task in this project are as follows:

1. Literature review on design-techniques of transmission lines at intermediate frequency ranges (0.01 – 10 GHz) on lossy substrates.
2. Investigation of loss minimization techniques by inspecting different transmission line concepts, corresponding geometrical parameters and substrate materials.
3. Investigate simulation techniques balancing lumped and distributed-element models and simulate designed geometries to accurately estimate all loss mechanisms.
4. Design and simulation of promising transmission lines including RF-interface for the packaged systems and estimating effects of vias, connectors, etc. at the I/O ports.

[1] CuvIELLO, William & Coulton, Derek. (2003). Thin Film High-Density Interconnect (HDI) Design Guidelines.

[2] W. Heinrich, "Full-wave analysis of conductor losses on MMIC transmission lines," *IEEE MTT-S International Microwave Symposium Digest*, Long Beach, CA, USA, 1989, pp. 911-914 vol.3, doi: 10.1109/MWSYM.1989.38870.

Was erwartet Sie?

- Intensive Betreuung durch eine:n Doktorand:in in engagiertem Team
- Einbindung der Forschungsergebnisse in wiss. Veröffentlichungen im Fachgebiet
- Kontakt zu führendem Industrieunternehmen

Wen suchen wir?

- Studierende mit angestrebtem Abschluss in EIT
- Interesse an Design und Simulation mit modernen 3D-Softwarepaketen
- Idealerweise Vorkenntnisse in der Mikrowellentechnik und Feldsimulation
- Kenntnisse in Programmierung (Python o.ä.) zur Datenanalyse

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