# CHAPTER 15

# ELECTRONIC SCIENCE

## Doctoral Theses

168. RATHI (Servin)

**Modeling, Simulation & Characterization of Modified Different Gate Geometric Double Gate High Electron Mobility Transistor for High Power and High Frequency Applications with Two Separate / Common Gate Control.**

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*Abstract*

An analytical model has been proposed to realize the effect of upper gate electrode in the T-gate structure as field plates. In the analysis the whole structure is divided into Metal Insulator Semiconductor (MIS)/Metal Semiconductor (MS) contact regions and then by applying condition of current continuity and using an interative approach device characteristics have been explored. Intensive simulation work has been carried out to study the effect of channel thickness ($d_c$) and gate-length variation for both DGHEMT and SGHEMT in order to analyze the proportional enhancement offered by DGHEMT. A compact, physical and short-channel threshold voltage ($V_{th}$) model is developed for DGHEMT which leads to the comprehensive study of short-channel effects and provides a physical insight into the device properties. Extensive simulation based analysis for higher breakdown voltage of recessed DG-HEMT for different gate-geometries (T-Gate, IL Gate, T-Gate etc) has been carried out.

*Contents*

1. Introduction. 2. T-Gate geometric HEMT : Physical analysis, modeling, comparison with normal gate and implementation as parasitic elements. 3. Microwave performance enhancement in double and single gate HEMT with channel thickness variation. 4. Threshold voltage and drain current model for nanoscale InAIAs-InGaAs double Gate-HEMT. 5. Gate-geometric recessed nano-scale $In_{0.52}Al_{0.48}As$-$In_{0.53}Ga_{0.47}As$ double Gate-HEMT for high breakdown voltage. 6. Conclusion and future scope.