Miniaturized Wideband Analog Phase Modulation in Phase Locked Loop

A Project Report

submitted by

D ANIL SRIKANTH

in partial fulfilment of the requirements
for the award of the degree of

MASTER OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY MADRAS.

JUNE 2020

THESIS CERTIFICATE

This is to certify that the thesis titled **Miniaturized Wideband Analog Phase Modulation in Phase Locked Loop**, submitted by **D ANIL SRIKANTH**, to the Indian Institute of Technology, Madras, for the award of the degree of **Master of Technology**, is a bona fide record of the research work done by him under my supervision. The contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

Dr. Saurabh Saxena
Project Guide
Assistant Professor
Dept. of Electrical Engineering
IIT Madras, 600 036

Place: Chennai

Date: 10^{th} June 2020

ACKNOWLEDGEMENTS

I would like to express my earnest gratitude to my guide Dr. Saurabh Saxena whose knowledge and dedication has inspired me in developing interest towards Analog circuits and to work efficiently on the project. I thank him for motivating me, allowing me freedom to exchange ideas and flexibility while working on the project.

I would like to express my sincere gratitude towards my team members R. Gautham, Jaya Deepthi who helped me in situations of need, with their experience, timely guidance and support.

This journey would not have been possible without the support of my family, professor and mentors, and friends. To my family, thank you for encouraging me in all of my pursuits and inspiring me to follow my dreams. I am especially grateful to my parents, who supported me emotionally and financially.

ABSTRACT

This thesis analyses and compares often used methods to widen the bandwidth for phase modulation and presents an alternative method of implementing a wideband phase modulator. The analysis shows that it requires a great degree of matching in both methods of pre-emphasis and two point modulation, however two point modulation doesn't require to control as many parameters as pre-emphasis. The proposed architecture is based on two-point modulation. In the proposed method PLL output is modulated by feeding a baseband signal at input and output of loop filter, in contrast to the typical way of changing the divider ratio through DSM. This avoids having quantisation noise obscuring the baseband signal at the output. The proposed architecture of a 2.2-2.3 GHz fractional-N synthesizer with support of wideband phase modulation is verified in frequency and time domains through a *Simulink* model and has been implemented on FR-4 PCB with dimensions of 2.6" $\times$ 2.6".

Note : *As this project is unpublished work, further details of this thesis will be made availbale after publishing the project work.*