香港城市大學 City University of Hong Kong

Department of Electronic Engineering

毫米波 State Key Laboratory of Millimeter Waves 國家重點實驗室（香港）

IEEE (HK) Section AP/MTT

Seminar on

Injection Locking Technique for Millimeter-wave Signal Generation and Division

by

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Abstract

In order to obtain a reference signal with a low phase noise, high frequency stability, and low cost for the microwave/millimeter-wave applications, the injection-locked oscillators have been widely used in the wireless, optics, and local network systems. In this thesis, the theory of injection locking is introduced to investigate the mechanism about the characteristics of the locking range, high-order harmonic injection, and the phase noise in injection-locked oscillator. With the injection-locked models, the behavior of injection locking is therefore understood for injection-locked oscillator designs. Based on the methods of fundamental, sub-, and super-harmonic injections, the relative millimeter-wave injection locking circuits have been achieved and fabricated by using CMOS and GaAs pHEMT techniques. The 60 GHz injection-locked oscillators and the 100 GHz injection-locked frequency divider are fulfilled with the good performances of low phase noise, wide locking range, and low power consumption through the simulations with the high-frequency transistor model. In addition, a 30 GHz analogy phase-locked loop using a divided-by 4 ring-type injection-locked frequency divider has also been designed and achieved by using 0.5 μm E/D mode GaAs pHEMT. Utilizing the known experiment results from the each function circuits such as the voltage-controlled oscillator, phase detector, dc amplifier within a loop filter, the 30 GHz PLL was successfully integrated to be a MMIC for Ka-band communication systems. This circuit proves that the injection-locked frequency divider can embedded in the PLL chip with a fine characteristic.

Biography

Fan-Hsiu Huang was born in Taipei, Taiwan, R.O.C. He received the M.S. degree and the Ph.D degree in electrical engineering from National Central University, Chungli, Taiwan, in June, 2003 and October, 2007, respectively. His research is interesting in microwave/millimeter-wave integrated circuits, fiber-optic communication front-end circuit design, and high-speed signal transmission. After he received the Ph.D degree, he was a postdoctoral researcher in Optical Sciences Center, National Central University, Taiwan, where he was engaged in researching and developing of microwave CMOS high-power switch and power amplifier circuits, injection locking technology, and 60 GHz phased array system. Since 2012, he joined the faculty at Chang Gung University as an assistant professor in the Department of Electronics Engineering. His currently research areas focus on microwave high-power devices and circuits, millimeter-wave monolithic integrated circuit, and high data rate wireless systems.

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***** ALL ARE WELCOME *****

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