Carleton University

Department of Electronics

Phase-Locked Loops and Receiver Synchronizers

Lecture Outline

Section I **Phase-Locked Loops**

1. Loop Components: phase-detectors, voltage-controlled oscillators, filters
2. First-order and second-order loop operation
3. Loop stability for first-order and second-order loops
4. Transient response: phase step, frequency step, linear frequency ramp
5. Sinusoidal phase modulation, sinusoidal frequency modulation, use of a PLL as a discriminator
6. Natural acquisition for first-order and second-order loops, phase plane method

Section II **Noise Performance**

7. Additive noise response for phase-detectors and for PLLs, output signal power spectrum, signal-to-noise ratio of a PLL used as a phase demodulator,
8. Signal-to-noise ration of a PLL use as a frequency demodulator, non-linear operation in the presence of noise, Fokker-Planck Method, Tikhonov PDF

Section III **Receiver Synchronizers**

9. Carrier Synchronizers: Squaring loop, Costas loop, Remodulator, phase variance
10. BPSK and QPSK bit error rate performance
11. Clock Synchronizers: Early-late gate synchronizers, Inphase/midphase synchronizers
12. Bit error rate performance, Delay line multiplier, Narrow Band Synchronizers

Text

Alain Blanchard, “Phase-Locked Loops: Applications to Coherent Receiver Design”, Wiley 1976, reprinted 1992

Course Grading

Three assignments worth 20% each
One written exam (3 hours open book) worth 40%