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INTRODUCTION

We must begin any treatment of PLL frequency acquisition with a review of the fundamentals of the PLL. Thereafter, the following subjects can be discussed (not necessarily in that order):

(a) The difference between the type I second-order and the type II second-order PLL and why the type II second-order PLL is usually preferred
(b) The mechanism for acquisition in an ordinary unassisted PLL
(c) The multiplying phase detector (numerical multiplier, analog multiplier, RF mixer, or XOR gate used as a multiplier) and effects of hard limiting
(d) The edge-triggered digital phase/frequency detector
(e) The ramp-and-sample phase detector and a technique to exploit its uniqueness to realize wideband capture acquisition assistance
(f) The quadricorrelator, balanced and unbalanced
(g) The Costas PLL, "Frequency Squaring" Carrier Recovery, etc.
(h) The clock and data recovery PLL
(i) PLL considerations for frequency synthesizers
(j) Signal-to-noise ratio (SNR) of the various phase detectors
(k) Short- and long-term phase and frequency settling effects in a PLL
(l) The effect of a phase detector dead zone on phase noise and wander
(m) The reduction or elimination of phase detector dead zone and impact on reference frequency suppression

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(n) Sweeping techniques
(o) Sweep disabling after lock and a self-disabling method
(p) False locking on data or modulation sidebands
(q) Preventing false lock on spurious signals, such as modulation sidebands
(r) Comments on converting an analog to an all-digital architecture
(s) Limiting acceleration in swept acquisition methods
(t) Cycle slipping due to excessive acceleration or modulation within the loop
(u) Killing the quadricorrelator output during final lock to suppress its otherwise added phase noise; using a dead zone versus a switch
(v) DC offsets and noise and the effect on PLL acquisition
(w) Heroic spur suppression using DC offset minimization and brickwall filtering
(x) Brute force methods such as wideband/narrowband PLL bandwidth modes
(y) The frequency ratio detector using counter techniques
(z) Advantages and disadvantages of different assistive techniques and when to use which technique