

# Table of Contents

*Foreword - by Steve Ciarcia, Founder/Editorial Director, Circuit Cellar Magazine*

*Introduction : Don't be afraid by the Darker side - A short introduction on the usual difficulties that electronic engineers could have to fight against*

## **Section 1 : Impedance concerns**

Chapter 1.1 Impedance matching basics (From an optimization of a basic DC-powered heater to the design and simulation of tuned AC matching networks)

Chapter 1.2 : Microstrip techniques (Design and play with zero-cost components, just by drawing copper tracks on your PCB !)

Chapter 1.3 : Time Domain Reflectometry (Design your own sub-nanosecond pulse generator for 5\$, and use it to measure and locate impedance mismatches.)

## **Section 2 : Electromagnetic compatibility**

Chapter 2.1 : Let's play with EMI (See and understand how a good design can drastically reduce electromagnetic interferences)

Chapter 2.2 : Cable shielding experiments (An experimental comparison of different cable shielding strategies, and their impact against capacitive and inductive coupling.)

## **Section 3 : Signal processing**

Chapter 3.1 : The Fast Fourier Transform from A to Z (Understand what is a FFT and how to use it.)

Chapter 3.2 : No fear with FIR : Put a Finite Impulse Response filter to work (From design to simulation and implementation of one of the most flexible digital filters, with extensive Scilab simulation examples.)

Chapter 3.3 : Multirate processing techniques and CIC filters (Or how to manage huge data throughput on reasonable size microprocessors or DSPs.)

## **Section 4 : Oscillators**

Chapter 4.1 : Let's be crystal clear (Crystal oscillators from A to Z, in order to understand their design and limitations)

Chapter 4.2 : Are you locked ? A PLL primer (From the internals of voltage controlled oscillator to the implementation of integer and fractional PLLs, one of the most useful building blocks for the engineer)

Chapter 4.3 : Direct digital synthesis 101 (Generate any frequency with fantastic resolution with a DDS, either hardware or firmware based. With actual implementation on a low cost microcontroller.)

## **Section 5 : Communications**

Chapter 5.1 : Open your eyes ! A primer on high speed signal transmission techniques (Understand what are equalization and emphasis and how to use them, with plenty of simulations and experiments.)

Chapter 5.2 : Digital modulations demystified (From FSK to QAM and OFDM, learn their basics to know when to use them.)

Chapter 5.3 : Antenna basics (Antenna concepts and simulation tools for ISM band systems.)

## **Section 6 : Power**

Chapter 6.1 : Low power techniques : Build better energy-saving systems (A step by step method to drastically reduce the power consumption of autonomous designs. )

Chapter 6.2 : From powerline measurements to PFC (Real or apparent power ? Theory and experiments on an actual AC/DC converter with a power factor corrector stage.)

## **Section 7 : System control**

Chapter 7.1 : PID control without math (How to design and tune a proportional-integrate-derivate controller. with plenty of simulations to understand the effects of each parameter)

Chapter 7.2 : Linear control basics (A quite simple example of linear control with an inversed pendulum platform, or how to deal with problems with more than one input and output.)

## **Annexes**

Annex 1 : Scilab tutorial

Annex 2 : Complex numbers 101

Annex 3 : References and sources