An open and free Scilab/Scicos toolbox for the modelling and simulation of communication systems

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1. INTRODUCTION

"Modnum"[1] is an open source and free Scilab/Scicos[2] toolbox for the modelling and simulation of communication systems. It is downloadable since March 2006 and have been primary designed for the research and development of new secured systems based on chaos[3]. Today the toolbox gives many Scilab functions and Scicos blocks that mainly focus on spread-spectrum systems for both Direct-Sequence(DS) systems and Frequency Hopping(FH) systems.

2. DS SYSTEMS COMPONENTS

Modnum provides functions which are in current use in digital stages of common communication and radar systems. One can find a wide variety of Scilab functions and discrete Scicos blocks to build base-band communication chains. A source palette details some useful generators like an uniform random integer number generator, Pseudo-Noise(PN) sequences generators -Maximal Linear Shift Register and Gold- and also some noise sources with normal and Rayleigh distribution. A communication palette is designed for digital modulations. M-ary Phase Shift Keying(PSK) modulation and M-ary and arbitrary Quadrature Amplitude Modulation(QAM) can be easily realized by using modulator/ demodulator blocks of that palette as well as spread and despread operations to do DS spread spectrum. Finally a dedicated palette for the digital filtering allows the design of useful Finite Impulse Response(FIR) filters such the Square Root Raised Cosine and Gaussian filters and two computational approaches for the FIR filters simulation are proposed.

3. FH SYSTEMS COMPONENTS

The toolbox gives also a palette for the modelling of integer and fractional frequency synthesizers : discrete models of tri-state Phase Frequency Detector(PFD), Charge Pump(CP), Voltage Controlled Oscillator(VCO) have been implemented to realize some simulations of a chaotic FH communication system. Delta-Sigma Modulators(DSM) can be found to realize simulation of Frequency Shift Keying(FSK) and Gaussian Minimum Shift Keying(GMSK) modulation scheme by using fractional frequency synthesizer. Models of Analog to Digital Converter(ADC) and Digital to Analog Converter (DAC), including some mistmatches, have been recently added to reinforce the possibilities of the toolbox concerning the specific field of modelling low phase noise carrier frequency synthesizers.

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4. TOOLS FOR ANALYSIS OF SIGNALS

Of course Modnum gives also blocks for the time-frequency analysis of signals encountered in communication systems. One can find typical Fast Fourier Transform(FFT) block, vectorial scopes to plot scattered diagrams, eye diagrams and more recently a spectrum analyzer scope based on a spectrum autocorrelation method.

5. PACKAGE

Modnum is fully documented and includes Scicos diagrams examples for Bit Error Ratio(BER) computation, Scilab simulation scripts using batch Scicos simulation functionalities and embedded man pages. Moreover it is multiplatform (Linux and Windows) and fully integrated in the Scilab/ Scicos working environment that is very attractive for engineering and for teaching of communication systems. So the "Scicos-Modnum" tandem proposes today a real free alternative to commercial toolboxes and softwares specialized in the communication system simulation at the system level.

6. CONCLUSION

The poster presentation will mainly focus on all previously cited functionalities and some particular approaches concerning implementation in Scilab/Scicos, computational methods and future developments of the toolbox will be done by speaking about the recent advances made in the new version of Scicos.

7. REFERENCES

[1] Modnum toolbox. `http://www.scicos.org/ScicosModNum/modnum_web/web/eng/eng.htm`.

[2] Scicos : Scilab's block diagram modeler/simulator. `http://www.scicos.org`.

[3] A. Layec. *Development of CAD models for the system level simulation of communication systems. Application to chaotic communications*. PhD thesis, University of Limoges, 2006.