Lab 2. Frequency Shift Keying

Total marks: 5 marks

1. Lab introductions

Frequency Shift Keying (FSK) is an important practical modulation scheme, and is the modulation technique of choice for many communication systems. While other modulation techniques, such as the two dimensional BPSK, or more complex QASK, may seem superior for a given application, practical considerations often sway things in favor of FSK. In this laboratory exercise, generation methods of FSK and its spectral characteristics will be the topic.

This lab consists of two experiments, namely Experiment 1 – VCO based generation of FSK, and Experiment 2 – Switch based generation of FSK. The experiments are carried out in the platform of **Matlab-Simulink**. You can access Matlab 2019b in UNSW myAccess without installing the software in your own computer. For instructions, please see Appendix A.

Simulation source files, i.e., FSKMethod1.SLX, FSKMethod2.SLX**,** and video demonstration are provided to assist you in this lab. What you need to do with the provided source files is to change the parameters as per Quiz Questions, and observe the output. **A report that addresses Quiz Questions is expected as the output of this lab, and based on which a mark will be given as part of the assessment of this course.**

2. Lab instructions and quiz questions

(a) Experiment 1 – VCO based generation of FSK

Open the file FSKMethod1.SLX in MATLAB 2019b, which is available in the link below.

https://weiwang-wys.github.io/files/Lab2/FSKMethod1.slx

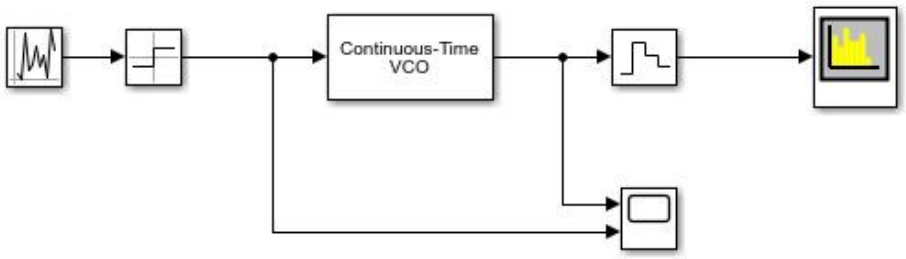


Fig. 2.1 VCO based generation of FSK (FSKMethod1.SLX)

Descriptions of each module in Fig. 2.1 are given in Appendix B. In this experiment, data rate of Binary Sequence Generator is set as R = 2000 bps, and center frequency of Continuous-Time VCO is set as fc = 8kHz. For detailed instruction, please watch the following video.

https://weiwang-wys.github.io/files/Lab2/LAB2combined.mp4

Based on Experiment 1, please answer the question below in your lab report.

Quiz Question 1. How can you set the "Input sensitivity" of Continuous-Time VCO to let modulation index h = 0.5, 1, 2, respectively? Please paste the three spectrums in your report and discuss their differences.

(b) Experiment 2 –Switch based generation of FSK

Open the file FSKMethod2.SLX in MATLAB 2019b, which is available in the link below.

https://weiwang-wys.github.io/files/Lab2/FSKMethod2.slx

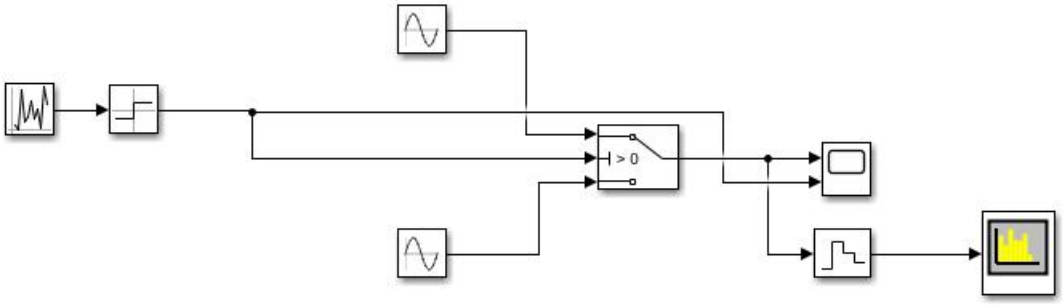


Fig. 2.2 Switch based generation of FSK (FSKMethod2.SLX)

Descriptions of each module in Fig. 2.2 are given in Appendix B. In this experiment, frequencies of Sine Wave Generators are set as f1= 2kHZ, f2=8kHZ, and data rate of Binary Sequence Generator is initially set as R = 280bps. For detailed instruction, please watch the following video.

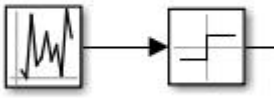
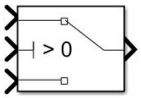
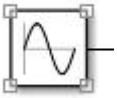
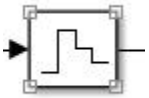
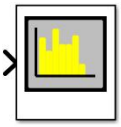
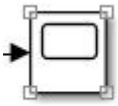
https://weiwang-wys.github.io/files/Lab2/LAB2combined.mp4

Based on Experiment 2, please answer the questions below in your lab report.

Quiz Question 2. Please observe the time-domain waveform of the generated FSK signal, does it have continuous phase? What is the necessary condition for the generated FSK to achieve continuous phase? Please verify your conjecture by changing the value of R.

Quiz Question 3. With f1= 2kHZ, f2=8kHZ, obeseve the spectrums of FSK signal with R= 50bps, 250bps, 1000bps, respectively. Please paste the three spectrums in your report and discuss their differences.

Appendix A-- Description of modules

	Sub-module 1:Uniform Random Number Generator (min value is set as -1, max value is set as 1) Sub-module 2： Sign function The whole module work as a binary sequence generator which generates random binary sequence with the values -1 and 1.
	VCO: Voltage controlled oscillator
	Switch (Dual switch)
	Sine wave generator
	Zero-order hold, which works as a sampler (a.k.a ADC, analog-to-digital converter)
	Spectrum Analyzer
	Scope