ÇANKAYA UNIVERSITY – ECE DEPARTMENT – ECE 376

2016 Spring Term   **February 2015**

Experiment 1 : AM Modulator Demodulator Design in Xilinx blocks

Experiment coded in MATLAB is given on course webpage with the names "ECE376_AM_Modulators_2015.mdl" and "ECE376_AM_Demodulator_2015.mdl"

1. Download the model file and the m file from the course web page and start MATLAB from "System Generator" icon. Open the model file, **"ECE376_AM_Modulators_2015.mdl".**

2. In this model file, you will see the generation (modulation) of full AM waveforms via two method, the upper one is called "Direct Method", while the lower one is called "Using Blocks". In both cases ROM and counter arrangements are used. By double clicking the ROM blocks, you will see that the relevant mathematical expression is written in the field of "Initial value vector" as multiplication of sinusoids or single sinusoids where the time (within one period) is sampled at a rate of 1024 times. Write down these expressions and identify their associations with the AM expressions given section 1 of lecture notes entitled, "ECE 376_AM_FM Demodulation_Jan 2013_HTE". Note that since we are using sinusoidal signals both for the carrier and the message signal, counters read the contents of ROMs cyclically.

3. Run the model file, **"ECE376_AM_Modulators_2015.mdl"** by pressing the triangular button on the top menu. Then double click the "Scope" and record in your report the waveforms you observe on the different channels of the Scope. Identify and associate these waveforms with the mathematical expressions you have written above.

4. Explain in details, the function of each block in the section of "Using Blocks".

5. When you have ensured you have fully understood the functioning the Modulator, now open "**ECE376_AM_Demodulator_2015.mdl**".

6. The model file **ECE376_AM_Demodulator_2015.mdl** is intended to demonstrate the importance of phase difference during demodulation.

7. For this purpose, in **ECE376_AM_Demodulator_2015.mdl**, the first line (row) of blocks generate full AM, while in the second and third rows, synchronous demodulation is performed. On the second row, the local carrier has no phase difference, on the third row a phase term is added to the local carrier. Observe these by double clicking on the ROM1 and ROM2 blocks. Note that filters are added on both the second and third rows to eliminate high frequency components so that message signal can be recovered successfully.

8. Write down in your lab report the relevant mathematical expressions of the demodulation process in the model file of **ECE376_AM_Demodulator_2015.mdl** and provide the necessary description for each step.

9. Now try to see the effect of changing the phase term of the local carrier in the ROM block of the third row of **ECE376_AM_Demodulator_2015.mdl**. To this end, vary the phase term in the range 0 to 2π and note in your report the effect of different phases.
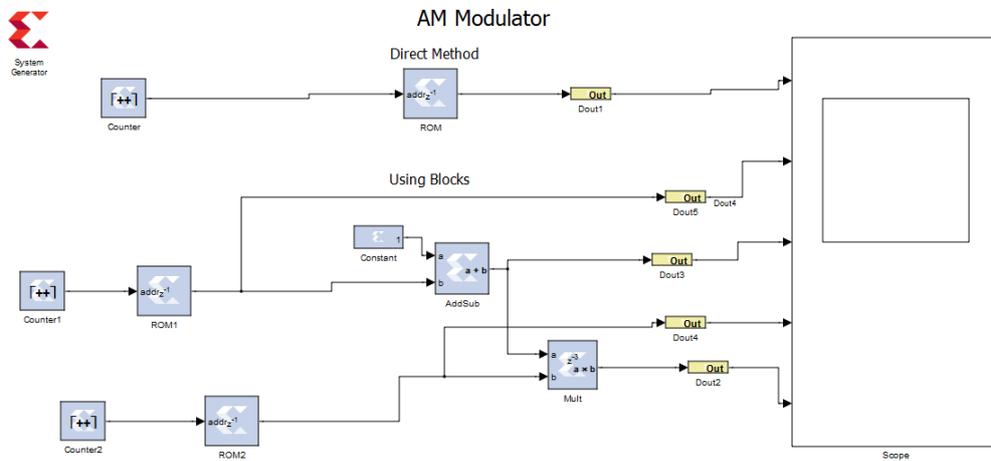

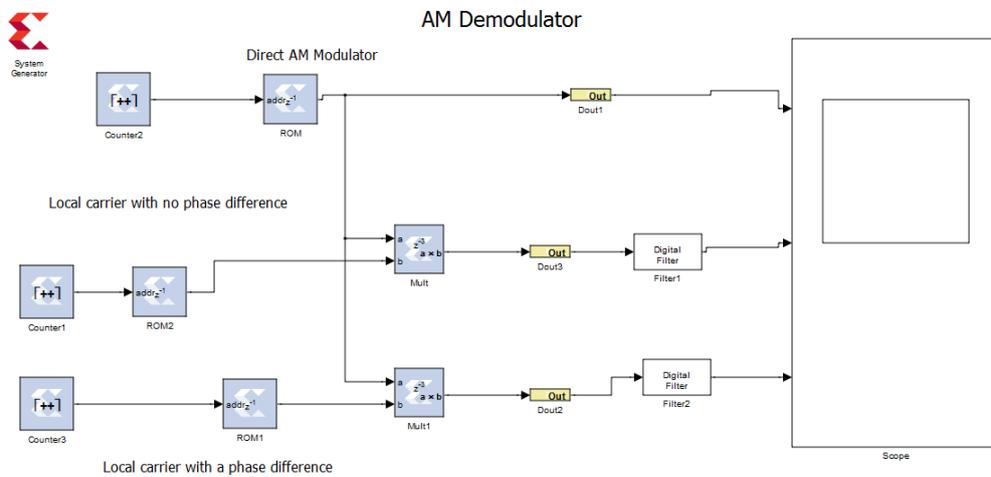Fig.1 Contents of the model file **ECE376_AM_Modulators_2015.mdl**.

Fig.2 Contents of the model file **ECE376_AM_Demodulator_2015.mdl**.