# Introduction to Time-Varying Electrical Networks : Week 10 

## Problem 1



Figure 1: LPTV system for problem 1.

The circuit shown above is an LPTV network. The chopper is a network of ideal switches that works as follows. When clk is high, nodes a and $b$ are connected to nodes $x$ and $y$ respectively. When clk is low, nodes a and $b$ are connected to nodes $y$ and $x$ respectively. The clk signal has a $50 \%$ duty cycle and frequency $f_{s}$. Assume that $R(C 1+C 2) \ll 1 / f_{s}$. Determine an expression for $H_{-k}\left(2 \pi k f_{s}\right)$ for any $k$, where $k$ is an integer, and $k \geq 0$. You might want to verify your answer with LTSPICE.

Determine an expression for $H_{-k}\left(2 \pi k f_{s}\right)$ for any $k$, where $k$ is an integer, and $k \geq 0$. You might want to verify your answer with LTSPICE.

## Problem 3



Figure 3: LPTV system for problem 3.

Repeat the problem for the circuit of Fig. 3. You might want to verify your answer with LTSPICE.

## Problem 2



Figure 2: LPTV system for problem 2.

The circuit shown above is an LPTV network. The chopper is activated by a clock signal (not shown in the figure) that has a $50 \%$ duty cycle and frequency $f_{s}$. Assume that $C_{1} / g_{m} \ll 1 / f_{s}$.

