July 20 Update

Simulating a Modulated Signal

From Kian's thesis we have the following formula for signals with frequency modulation:

$$X_t = \sum_m \mu_m cos(2\pi f_m t + 2\pi \int_0^t \phi_m(\tau)d\tau) + Z_t$$

Now let $\theta(t) = 2\pi f_m t + 2\pi \int_0^t \phi_m(\tau)d\tau$. Since ϕ and θ are both polynomials, we can simplify to:

$$\phi(\tau) = \sum_{p=0}^{P} a_p \tau^p$$

$$\theta(t) = 2\pi f_m t + 2\pi \int_0^t \sum_{p=0}^{P} a_p \tau^p d\tau$$

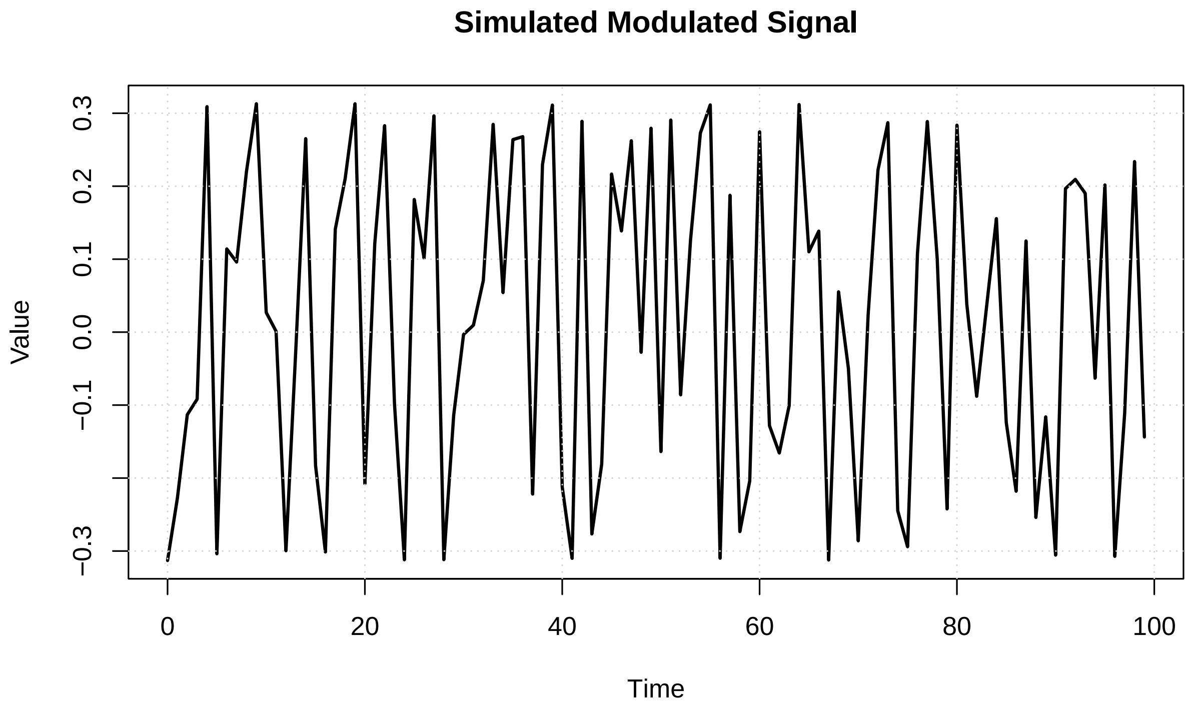
$$\theta(t) = 2\pi f_m t + 2\pi \int_0^t \sum_{p=0}^{P} \frac{a_p}{p+1} t^{p+1}$$

Using these formulas I wrote a function to simulate a modulated signal given a length N, number of frequencies m, and the maximim degree of polynomial to consider P.

```
## Simulating modulated signal
set.seed(1)
Tt = simTt_mod(N = 100, numFreq = 1, P = 2)

## Printing the corresponding summation
print(Tt$fn)
```

```
## [1] "(-0.313)*cos(2*3.142*(1.827*t + 0.665*t^1 + 0.318*t^2 + 0.069*t^3 + 0))"
```



Simulated Modulated Signal
Value
0.3
0.2
0.1
0.0
−0.1
−0.3
0
20
40
60
80
100
Time