

MTE 1001

# Fundamentals of Sound Synthesis

## Readings:

**Previously:** “Fixed Time Delay Effects”, Chapter 10,  
pp. 432-440  
(Readings 10c)

**New:** None

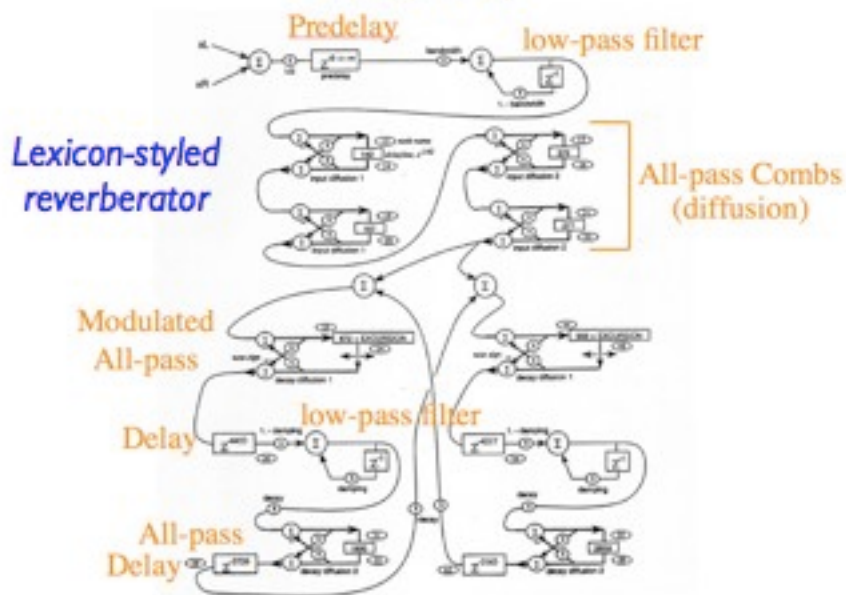
## Review

David Griesinger  
Lexicon



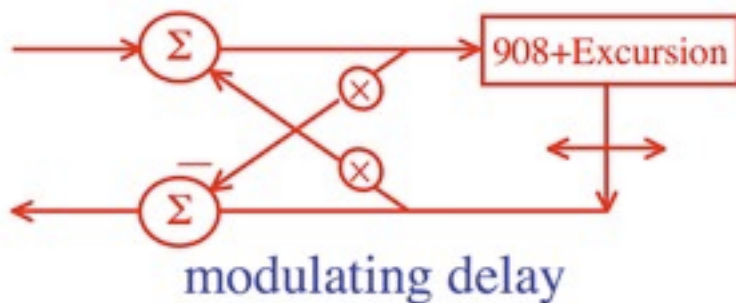
*First to implement modulating delays as part of  
a reverberator.*

## Review



## Review

### Modulating Allpass Comb



Modulation rate  $\sim 1$  Hz

Excursion  $\sim 0.3$  msec (12 samples @ 44.1)

## Digital Delays

The availability of bigger and cheaper memory chips opened up the market for a wide range of effects processors based on digital delays!

## Digital Delays

### Delay Effects (when added to the original signal)

delay < 10 ms    *comb filter, timbre effects*

10 ms < delay < 50 ms    *double tracking, chorusing*

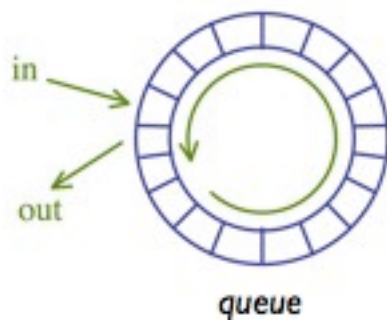
50 ms < delay            *echos*

*10 ms = 100 Hz*

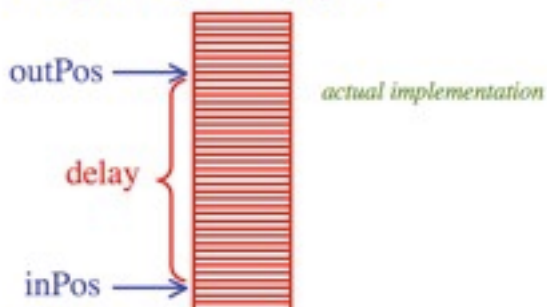
*50 ms = 20 Hz*

## Digital Delays

### How are they implemented?



## Digital Delays

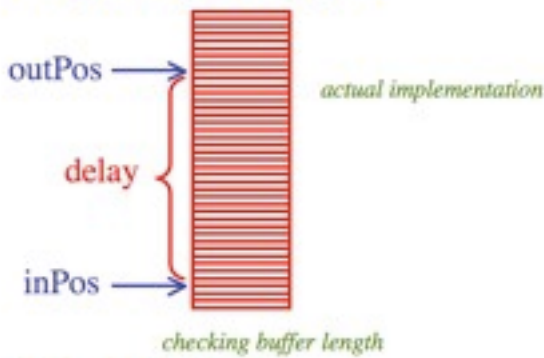


buffer length is usually larger than needed  
$$\text{outPos} = \text{inPos} - \text{delay};$$

```
buffer[inPos] = in;  
out = buffer[outPos]
```

## Digital Delays

Indexes into the buffer have to be incremented for every sample



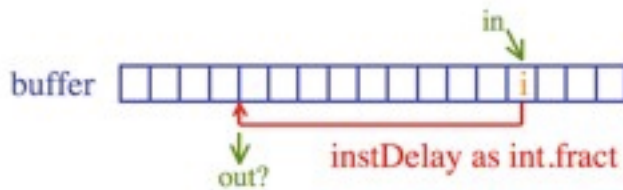
repeated for every output sample

```

inPos = inPos + 1;
outPos = outPos + 1;
if(inPos >=buffer.length) inPos = 0;
if(outPos >=buffer.length) outPos = 0;
    
```

## Digital Delays

How do we implement fractional delays?

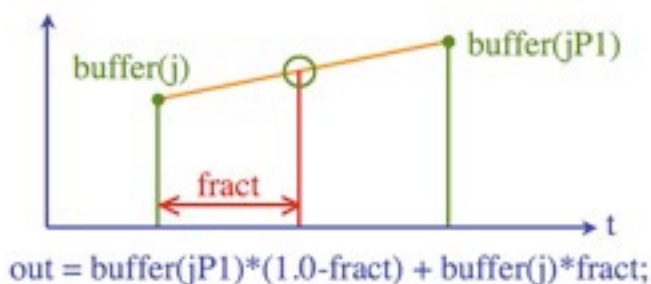


With indexes that have an integer and a fractional part (just like digital oscillators!)

*Especially for modulated delays we need fractional delays!*

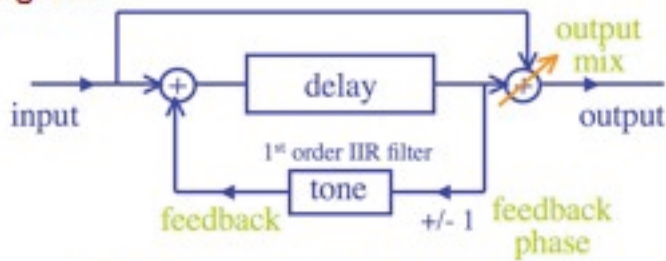
## Digital Delays

Just like digital oscillators, delays can/need to be interpolating!

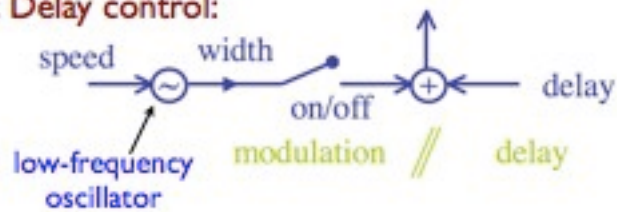


# Generic Effects Processor

Audio signals:

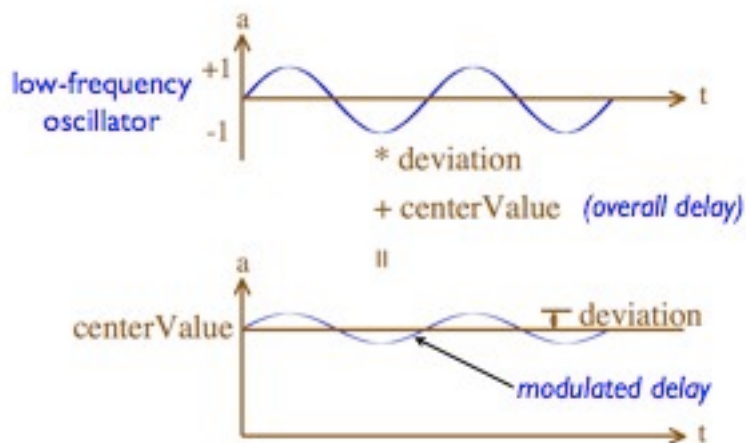


Dynamic Delay control:



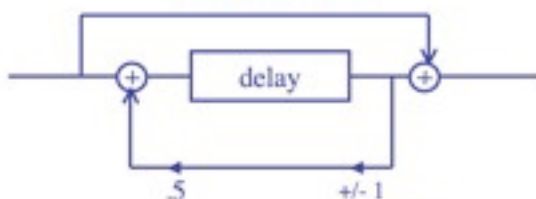
# Generic Effects Processor

## Modulating the delay



# Generic Effects Processor

## "flanging"



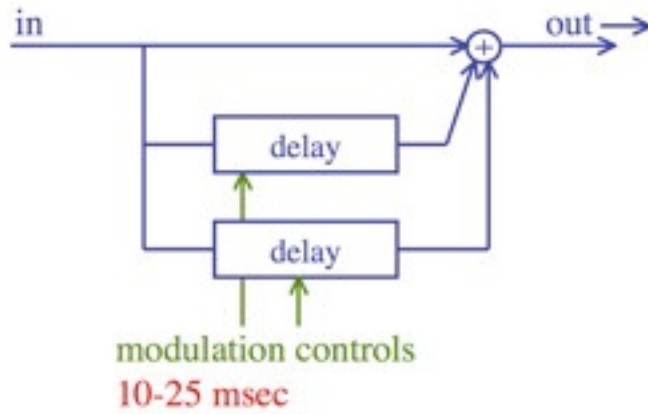
+1 metallic, zingy  
-1 whoosh, hollow

delay  
5 ms 200 Hz  
20 ms 50 Hz



# Generic Effects Processor

**“chorusing”**



**Next:**

Notebook #3

Due: Monday, May 23

Starts with Granular Synthesis  
& Soundscape Composition  
(Synthesis Lecture 16)