
Mike
&
Paul

Short Excerpt from MIT Lecture

MIT OpenCourseWare

Physics 8.02

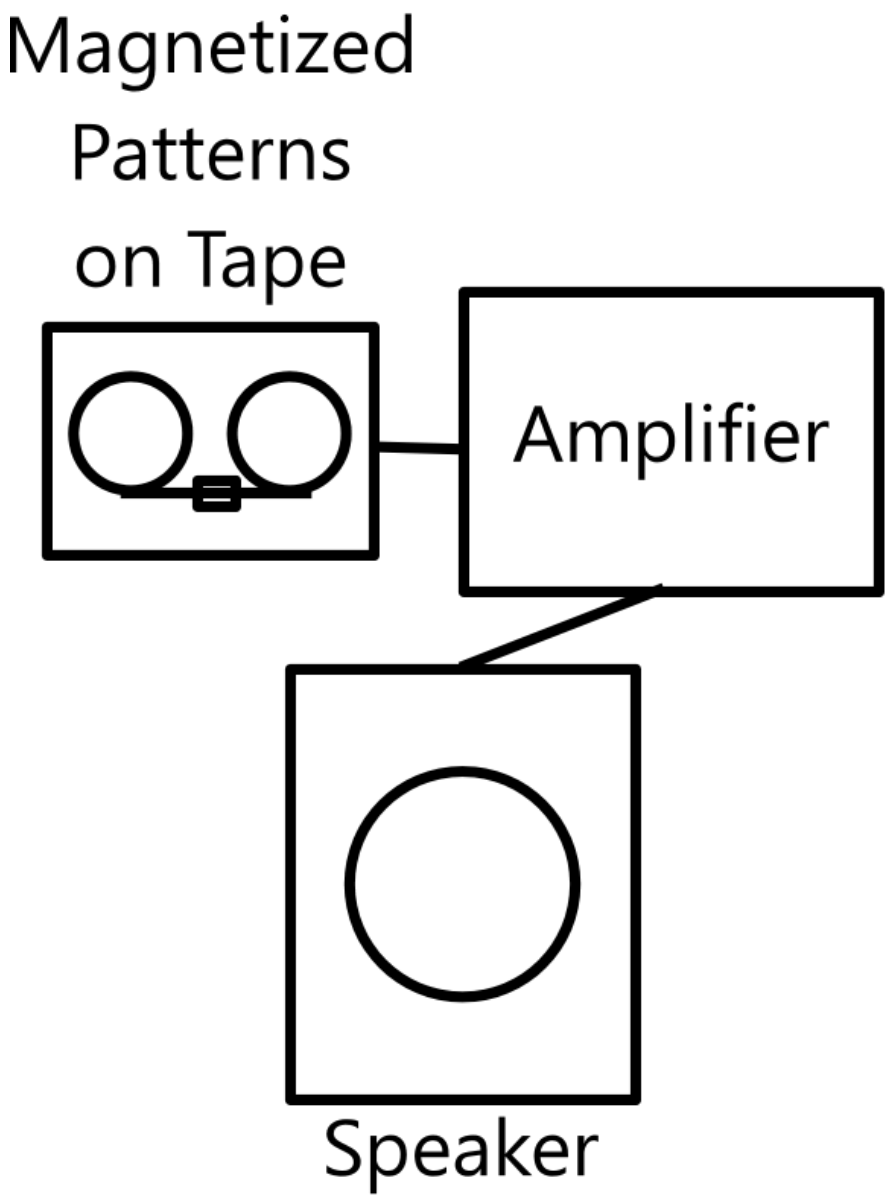
Lecture 11: Magnetic field and Lorentz Force

11:20 to 12:45

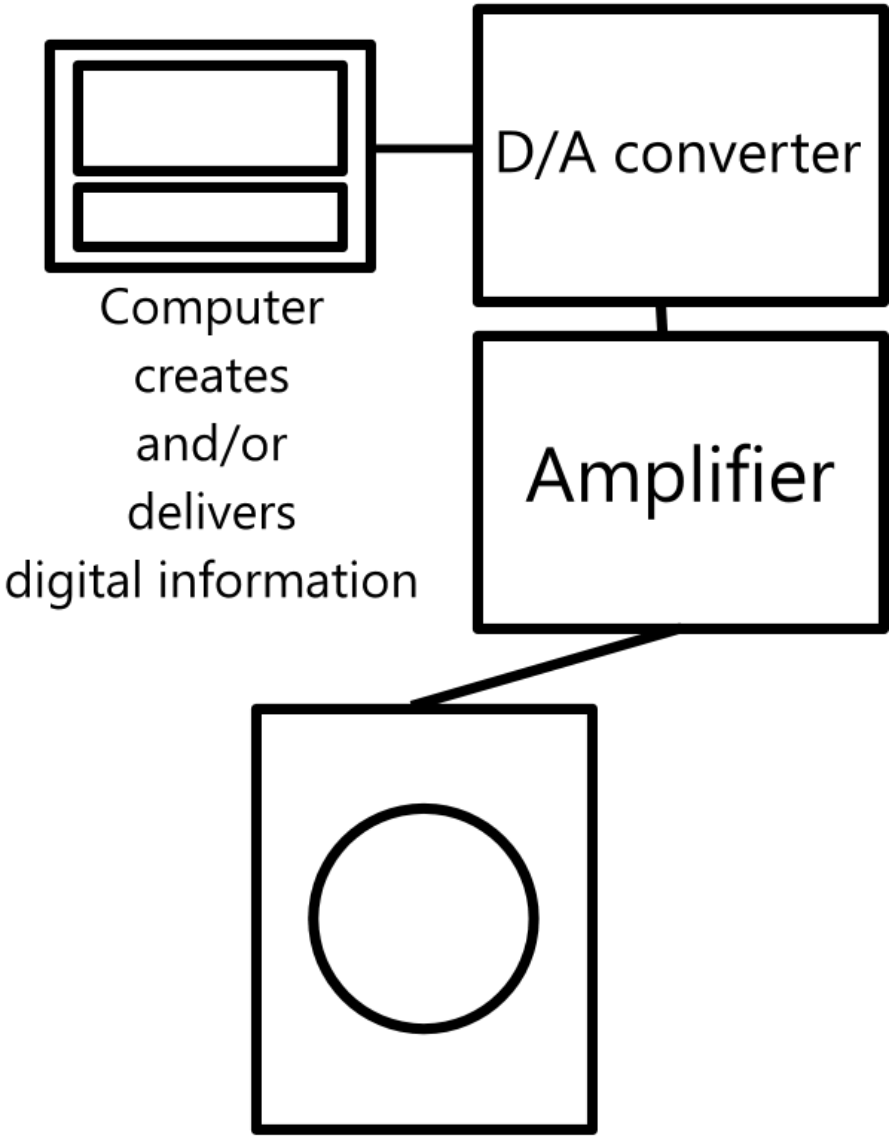
1 Minute 25 Sec

Video on Linear Motor and Application

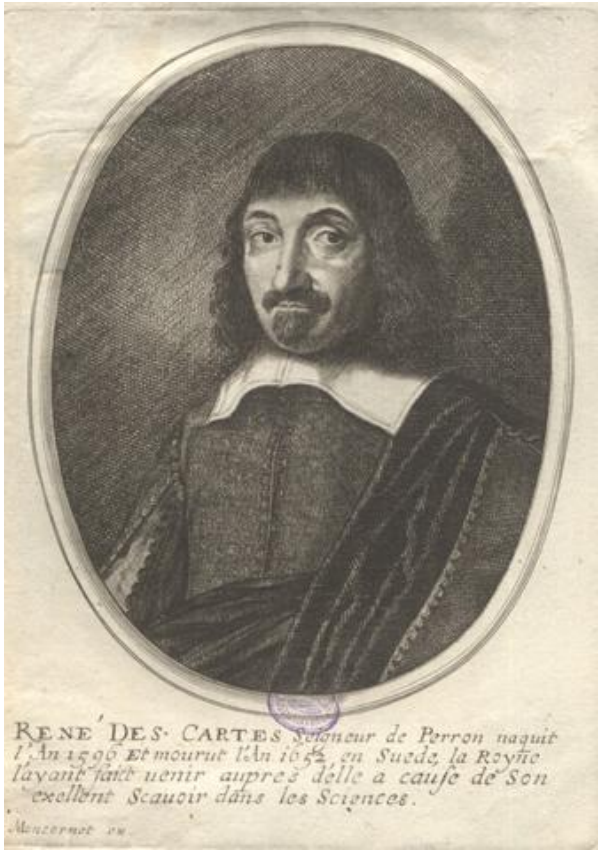
Analog



Digital

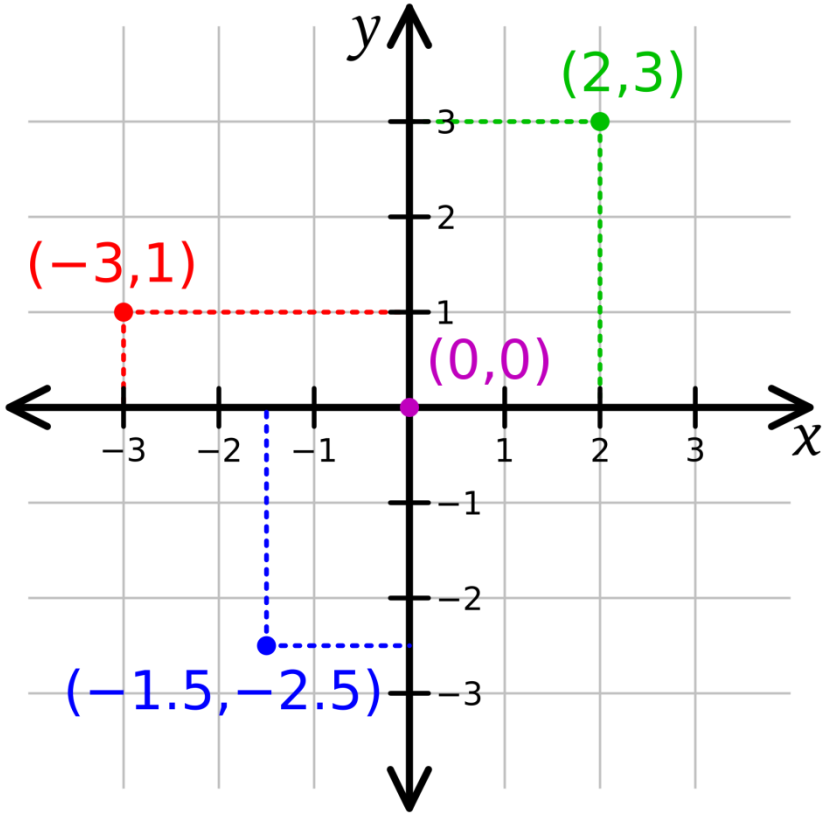

D/A converter
Computer
creates
and/or
delivers
digital information
Amplifier
Speaker

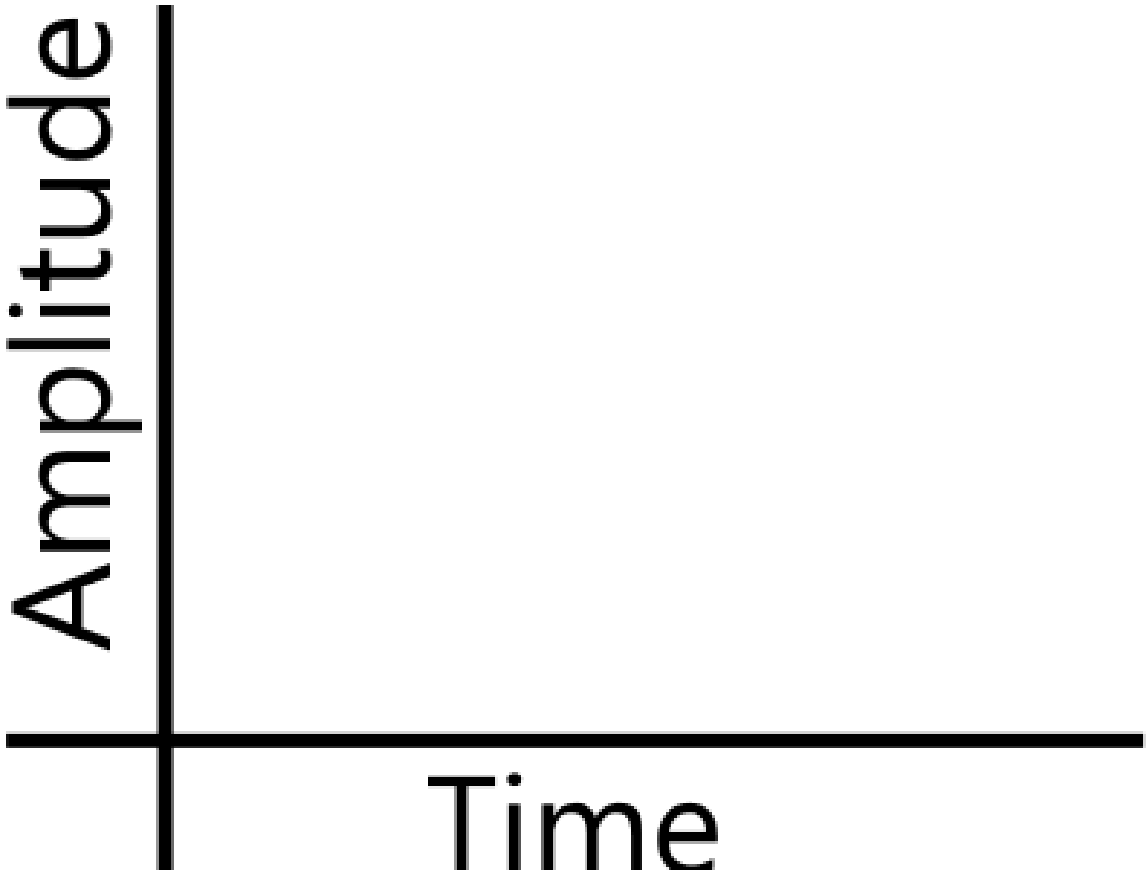
René Descartes
1596 – 1650



"I think, therefore I am."

Cartesian coordinate system





Time/Sample Rate = 44,100 Hz CD and 96,000 Hz Blue Ray

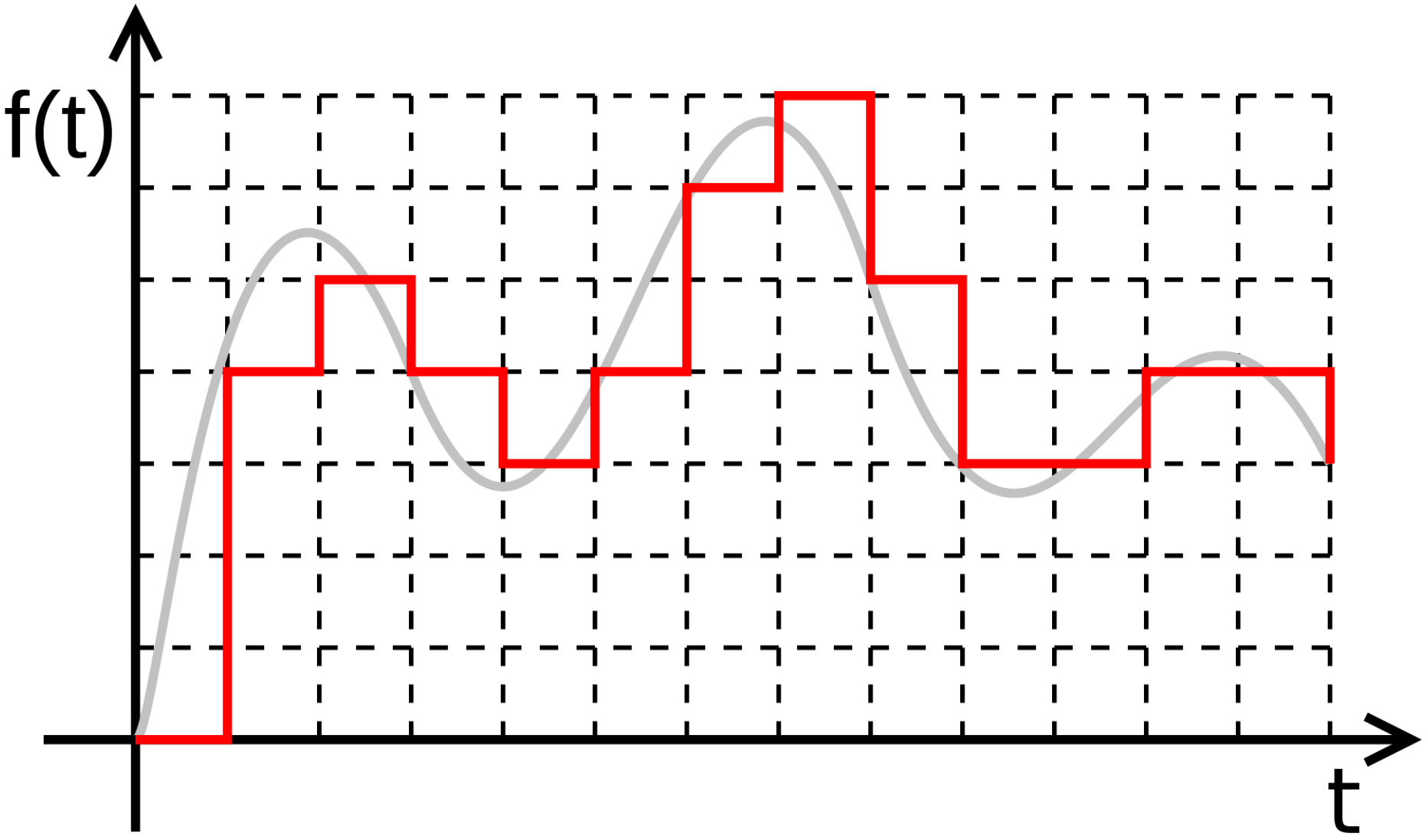
Audio Bit Depth= 16 bit CD and 24 bit Blue Ray

2 to the 16 power =65536

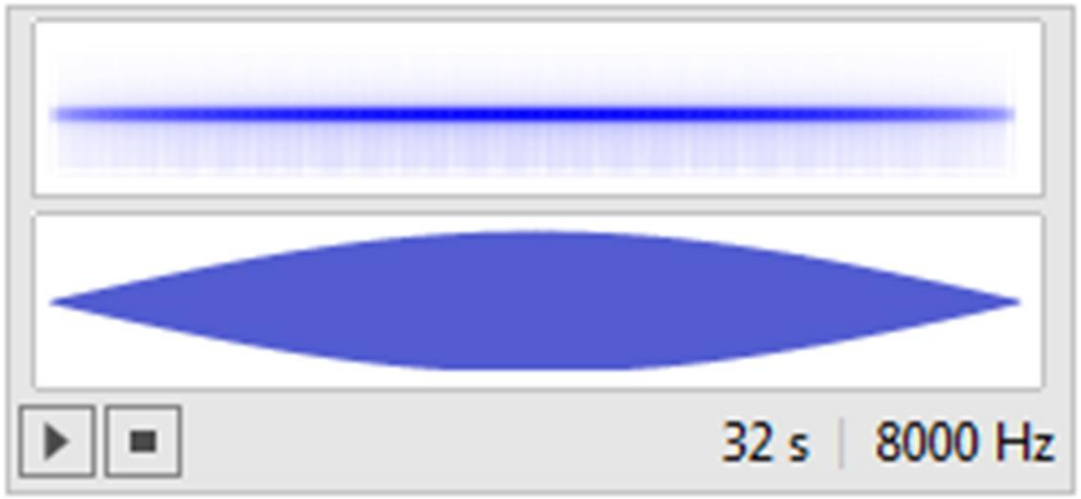
2 to the 24 power=16777216

Fourier Demo

Continuous vs. Discrete

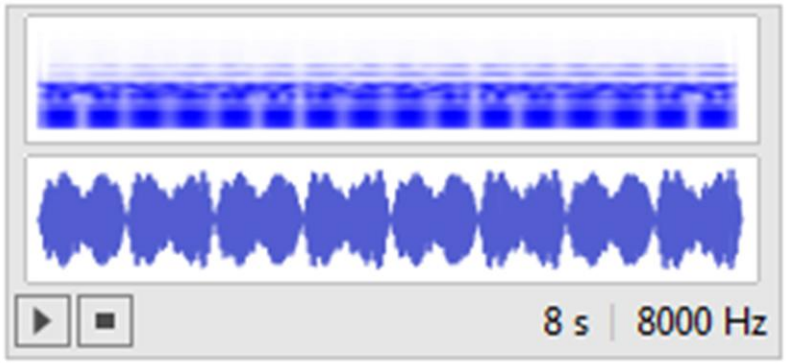

f(t)
t

```
Play[(Sin[Pi (1 / 32) t] * (Sin[440 * (3 / 2) * Pi t])) +
   (Sin[(1 / 32) Pi t] * Sin[(440 * 5 / 4) * Pi t]),
 {t, 0, 32}, SampleDepth → 16, PlayRange → All]
```



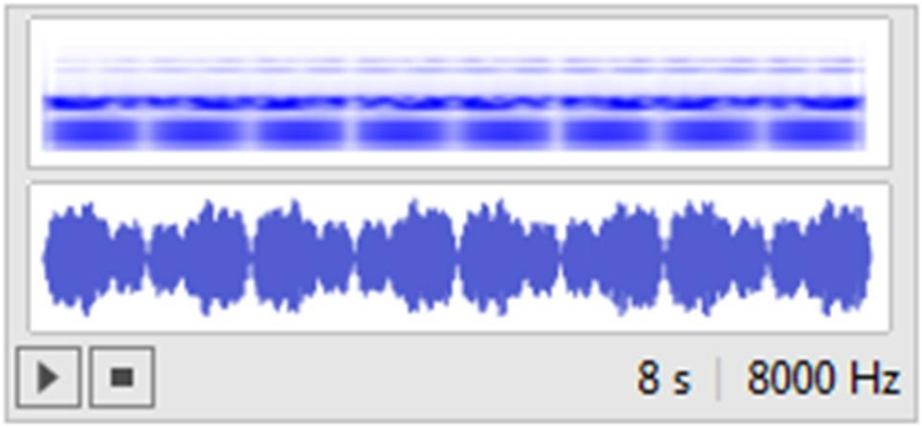

```
Export["Klee5.wav", %]
```

```
Play[
 Sin[Pi 2 t] *
   ((Sin[110 * Pi t]) +
     (Sin[5 * Pi t] * Sin[(220 * 3 / 2) * Pi t])) +
  (.4 * ((Sin[Pi t] * (Sin[440 * Pi t])) +
       (Sin[3 * Pi t] * Sin[(440 * 9 / 8) * Pi t]) +
       (Sin[6 * Pi t] * Sin[(440 * 5 / 4) * Pi t]))) +
  (.02 t *
    (Sin[Pi (2 t)] *
      ((Sin[880 * 9 / 8 * Pi t]) +
        (Sin[3 * Pi t] *
          Sin[(880 * 9 / 8 * 3 / 2) * Pi t])))),
 {t, 0, 8}, SampleDepth → 16, PlayRange → All]
```



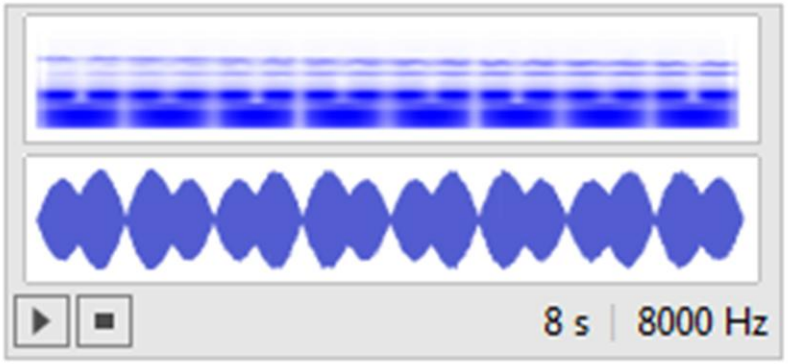

```
Export["Klee1.wav", %]
```

```
Play[(Sin[Pi t] * (Sin[110 * (4 / 3) * Pi t])) +
   (Sin[2 * Pi t] * Sin[(220 * (4 / 3) * (3 / 2)) * Pi t]) +
   (Sin[Pi t] * (Sin[440 * Pi t])) +
   (Sin[3 * Pi t] * Sin[(440 * 9 / 8) * Pi t]) +
   (Sin[6 * Pi t] * Sin[(440 * 5 / 4) * Pi t]) +
   (.04 t *
     (Sin[Pi 2 t] *
       ((Sin[1760 * 9 / 8 * Pi t]) +
         (Sin[3 * Pi t] * Sin[(1760 * 9 / 8 * 3 / 2) * Pi t])))),
 {t, 0, 8}, SampleDepth → 16, PlayRange → All]
```



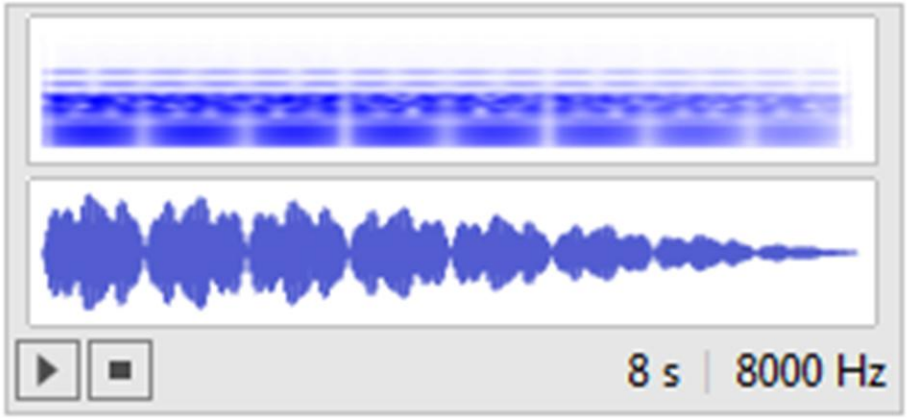

```
Export["Klee2.wav", %]
```

```
Play[
 (.1 *
    (Sin[Pi 2 t] *
      ((Sin[(1760 - 25 t) *9/8 *  Pi t]) +
        (Sin[5 * Pi t] *
          Sin[((1760 - 25 t) *5/4) * Pi t])))) +
  (Sin[Pi t] * (Sin[110 * Pi t])) +
  (Sin[2 * Pi t] * Sin[(220 * 3/2) * Pi t]) +
  (.02 t *
    ( Sin[Pi (2 t)] *
      ((Sin[880 *9/8 *  Pi t]) +
        (Sin[3 * Pi t] *
          Sin[(880 * 9/8 * 3/2) * Pi t])))),
 {t, 0, 8}, SampleDepth → 16, PlayRange → All]
```




```
Export["Klee3.wav", %]
```

```
Play[
 (Sin[Pi * (1 / 16 * (8 - t))] *
    ((Sin[Pi t] * (Sin[110 * Pi t])) +
      (Sin[3 * Pi t] * Sin[(220 * 3 / 2) * Pi t]) +
      (Sin[Pi t] * (Sin[440 * Pi t])) +
      (Sin[3 * Pi t] * Sin[(440 * 9 / 8) * Pi t]) +
      (Sin[6 * Pi t] * Sin[(440 * 5 / 4) * Pi t]))) +
  (.02 (8 - t) *
    ( Sin[Pi (2 t)] * ((Sin[880 * (9 / 8) * Pi t])) +
      (Sin[2 * Pi t] * Sin[(880 * ( 15 / 8)) * Pi t])))
 , {t, 0, 8}, SampleDepth → 16, PlayRange → All]
```




```
Export["Klee4.wav", %]
```

Fourier Mathematics

Paul Klee Composition

	Pythagorean Tuning	Just Intonation	Equal Temperament
Unison	1:1	1:1	1:1
Major Second	9:8	9:8	1122:1000
Major Third	81:64	5:4	1260:1000
Perfect Fourth	4:3	4:3	1335:1000
Perfect Fifth	3:2	3:2	1498:1000
Major Sixth	27:16	5:3	1682:1000
Major Seventh	243:128	15:8	1888:1000
Octave	2:1	2:1	2000:1000