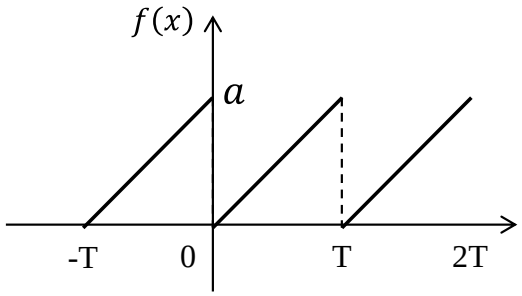
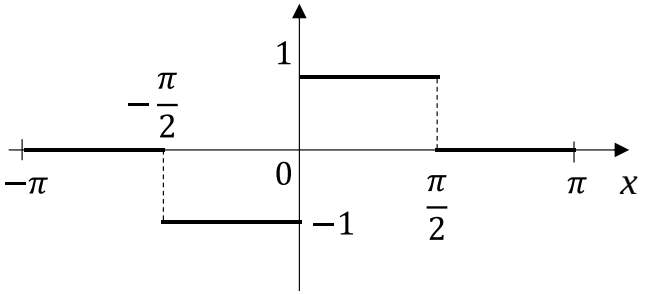
We know how to calculate Fourier series and transforms from given functions.
But what if we don`t know what the underlying function is?

$f(x)$ : A given function

e.g.



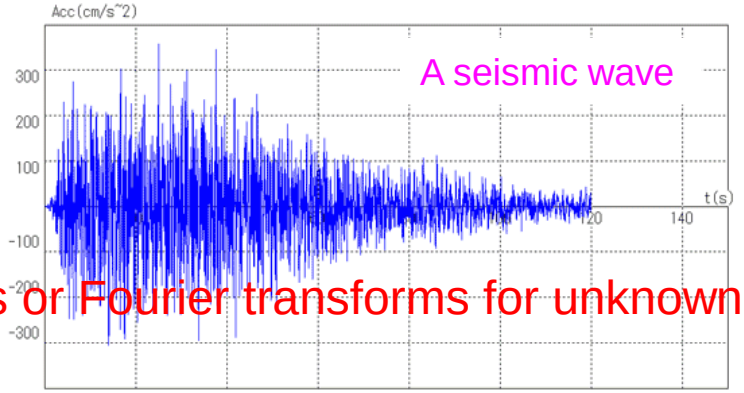

$$f(x) = \frac{ax}{T} \quad 0 \le x < T, \quad f(x+T) = f(x)$$

$$f(x) = \begin{cases} 1 & if \quad 0 \le x < \pi/2 \\ -1 & if \quad -\pi/2 \le x \le 0 \end{cases}$$

$f(x)$ : Unknown

e.g.

Natural phenomena




How can we find Fourier series or Fourier transforms for unknown functions?

For an unknown function, we need to move from integration to numerical calculation

Integration → Numerical calculation

Analog data → Digital data

Continuous functions

Discretization

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Another viewpoint

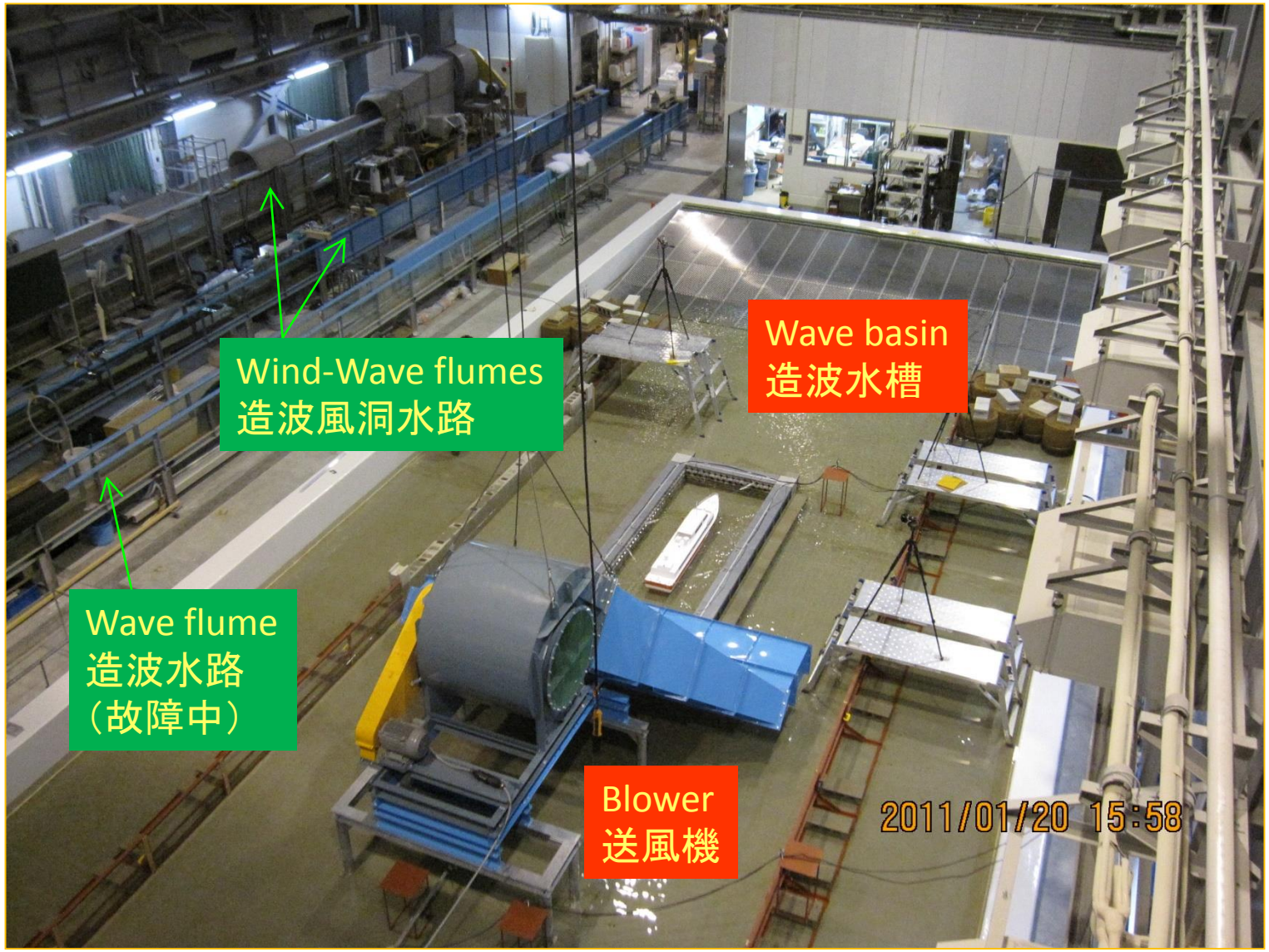
- ✓ Data are often obtained by field observations, model experiments, etc.
- ✓ Data is usually analyzed using PC.

The output is Digital data

Discrete Fourier Transform (DFT)
Fast Fourier Transform (FFT)

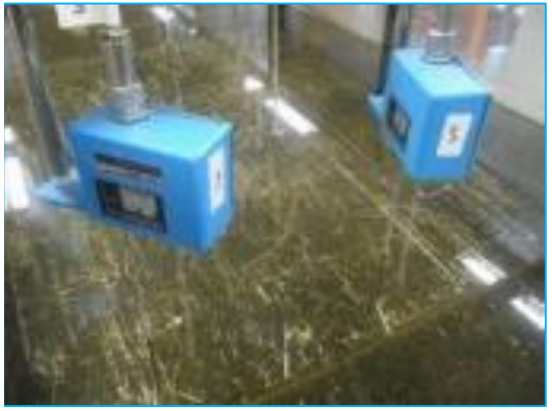
# Examples of digital data

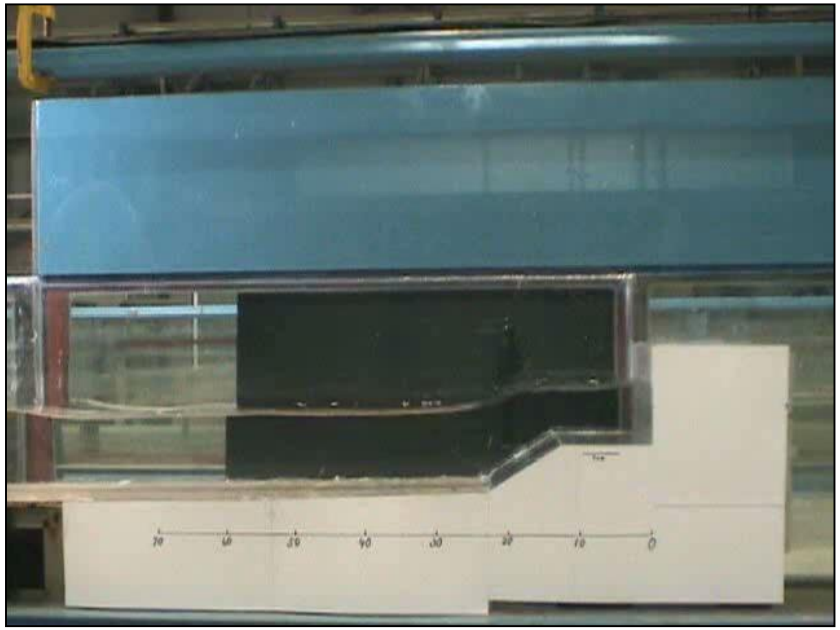
Experimental facilities of coastal and ocean engineering laboratory



# Model experiments

Wave gauge





# Examples of Wave data