

# Lab 3

*School of Architecture, Civil and  
Environmental Engineering*

*EPFL, SS 2023-2024*

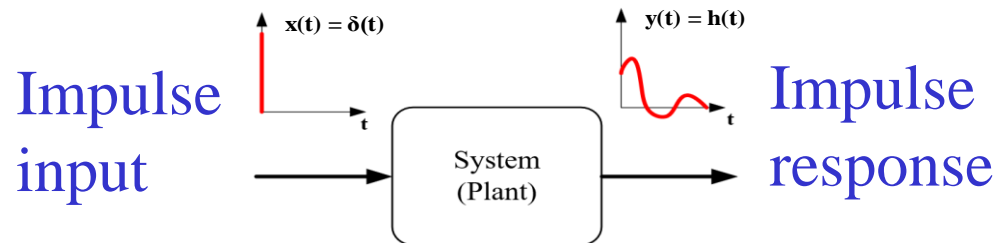
[http://disal.epfl.ch/teaching/signals\\_instruments\\_systems/](http://disal.epfl.ch/teaching/signals_instruments_systems/)

# Lab 3 outline

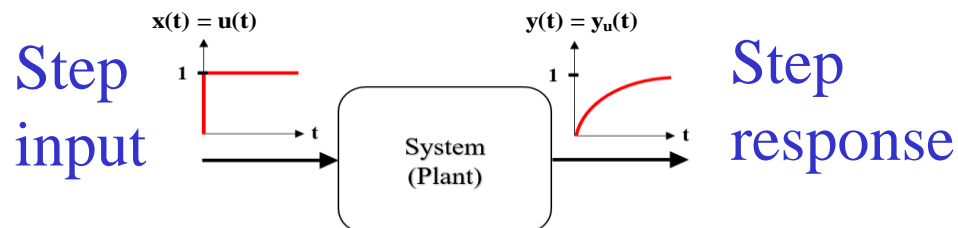
- Concept:
  - Responses (Step and impulse response)
  - Continuous-Time Transforms (LT, CTFT)
- Tools:
  - Matlab

# Reminder: Impulse and Step Response

- **Impulse response:** Time evolution of its output when input is impulse function



- **Step response:** Time evolution of its output when input is step function



# Reminder: Fourier Transform

$$\hat{f}(\xi) = \int_{-\infty}^{\infty} f(t) \cdot e^{-i2\pi\xi t} dt$$

$$f(t) = \int_{-\infty}^{\infty} \hat{f}(\xi) \cdot e^{i2\pi t\xi} d\xi$$

The Fourier Transform is a special case of the Laplace Transform

`fourier()` → Symbolic CT Fourier Transform  
`ifourier()` → Symbolic Inverse CT Fourier Transform

# Reminder: Laplace Transform

$$F(s) = \mathcal{L}\{f(t)\} = \int_{-\infty}^{\infty} e^{-st} f(t) dt$$

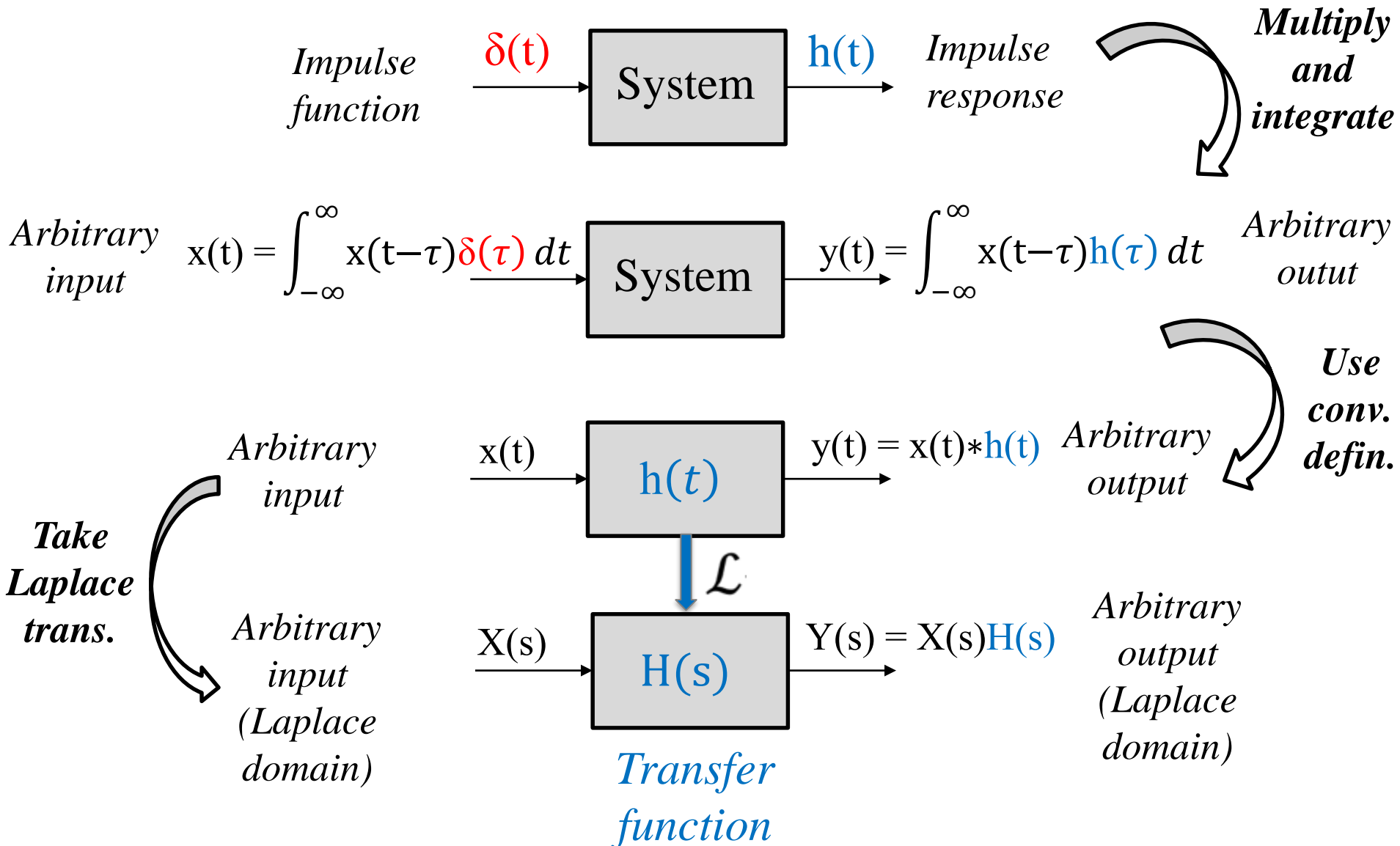
$$s = \sigma + i\omega$$

\*The Laplace transform is an extension of Fourier transform to allow analysis of broader class of signals and systems

\*Check transform tables in appendix

`laplace()` → Symbolic Laplace Transform  
`ilaplace()` → Symbolic Inverse Laplace Transform

# Reminder: System Analysis with Response and Transforms



# General Remarks

- Check type of questions (**Q,S,I,B**)\*\*\*
- Questions for which you need to use Laplace Transform tables are in annex
- Check **MATLAB help** to learn how to use functions\*\*\*
- Check given material, carefully read explanations and templates
- Pay attention to Hints and Notes
- It is about 3h, assistance will be given.

# Reminder: Symbolic Toolbox in MATLAB

- `syms x,y,z` → Define symbolic variables
- `z = x + y` → Define functions
- `assume(x>0)` → Assumption on variables
- `sympref('HeavisideAtOrigin',1)` → Symbolic preferences
- `fplot()` → Plot symbolic functions
- `Heaviside()` → Step function
- `tf()` → Define transfer function
- `step()` → Plot step response
- `int()` → Symbolic integration

**\*\*\* Check MATLAB help to learn how to use it**

# Feedback form

Please fill the feedback form for Lab 3!