Topic 3 - Part 2:
All the “transforms”

Linear systems and circuit applications

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Based also on Professor Óscar Barquero Perez, Andrés Martínez and José Luis Rojo’s slides

Laplace and Standard Fourier Transforms

- **Laplace and STANDARD Fourier transform for a generic signal x(t) - Definition:**

$$X(s) = \int_{-\infty}^{+\infty} x(t) e^{-st} dt$$

$$X(\omega) = \int_{-\infty}^{+\infty} x(t) e^{-j\omega t} dt$$

Existence of Laplace and Standard Fourier Transforms

- the integral should exist for each “s” and “w”:

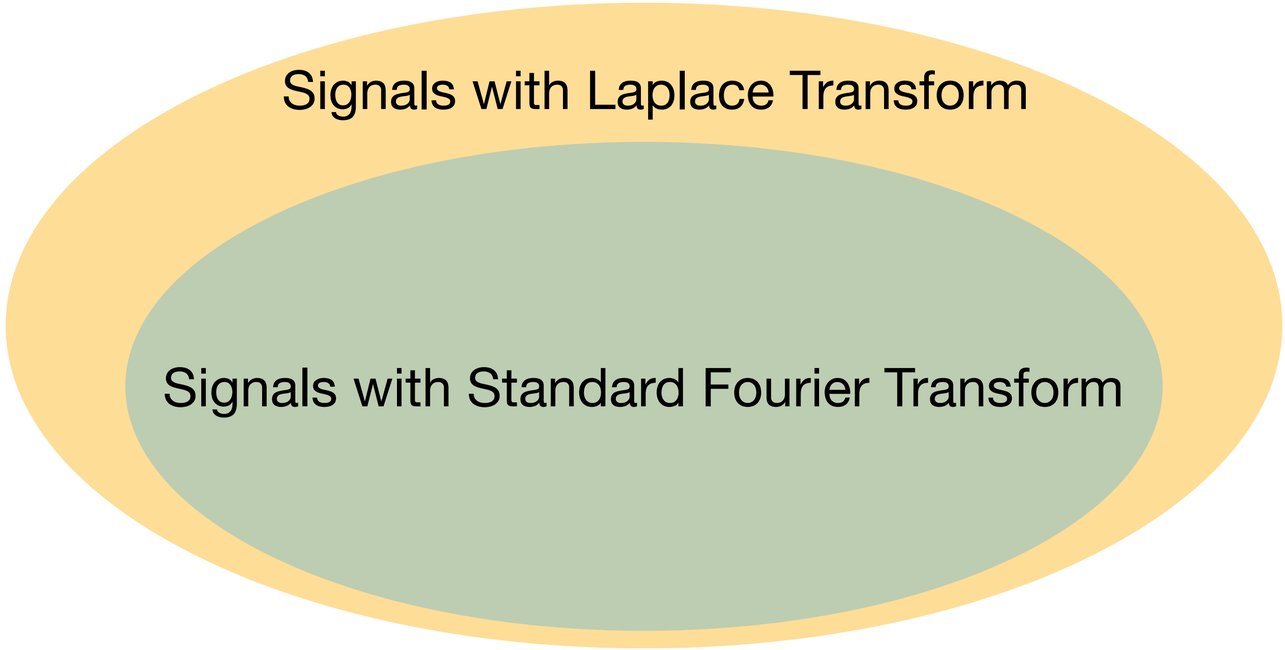
$$\int_{-\infty}^{+\infty} x(t)e^{-st}dt$$

$$\int_{-\infty}^{+\infty} x(t)e^{-j\omega t}dt$$

- They must be FINITE and EXIST for all “s” and “w”

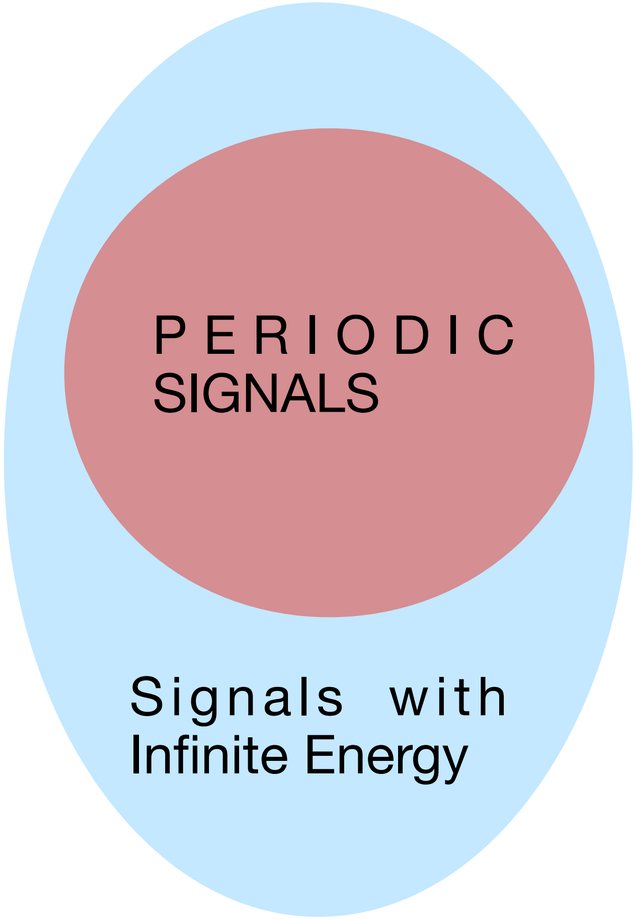
Laplace and Standard Fourier transforms

- **Some signals/functions do not have Laplace Transform.**
- **And even less signals/functions have Standard Fourier Transform….**

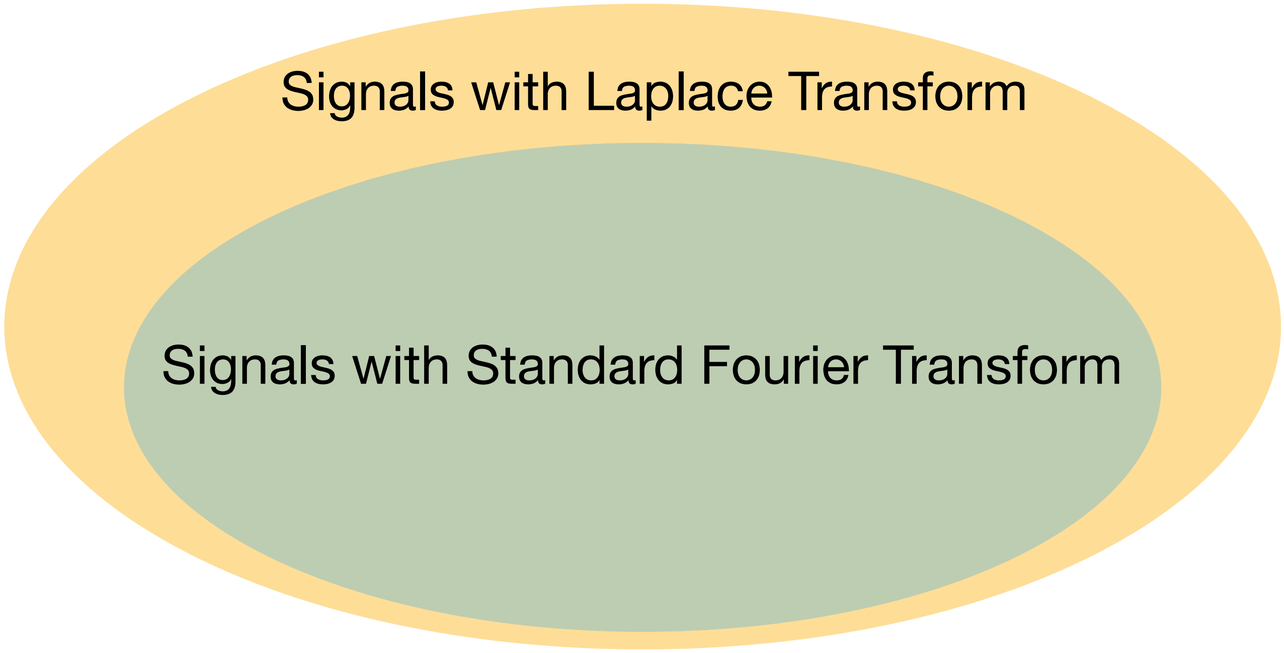


Laplace and Standard Fourier transforms

- **PERIODIC SIGNALS HAVE NOT LAPLACE/FOURIER**



Laplace permite la transformación de algunos señales de energía infinita también…



For a periodic signal? transformed domain?

- **For periodic signals ===> Fourier series (FS)**
- *... and the* ***Generalized Fourier Transform***
- ***(more generally, for some signals with infinite energy...)***

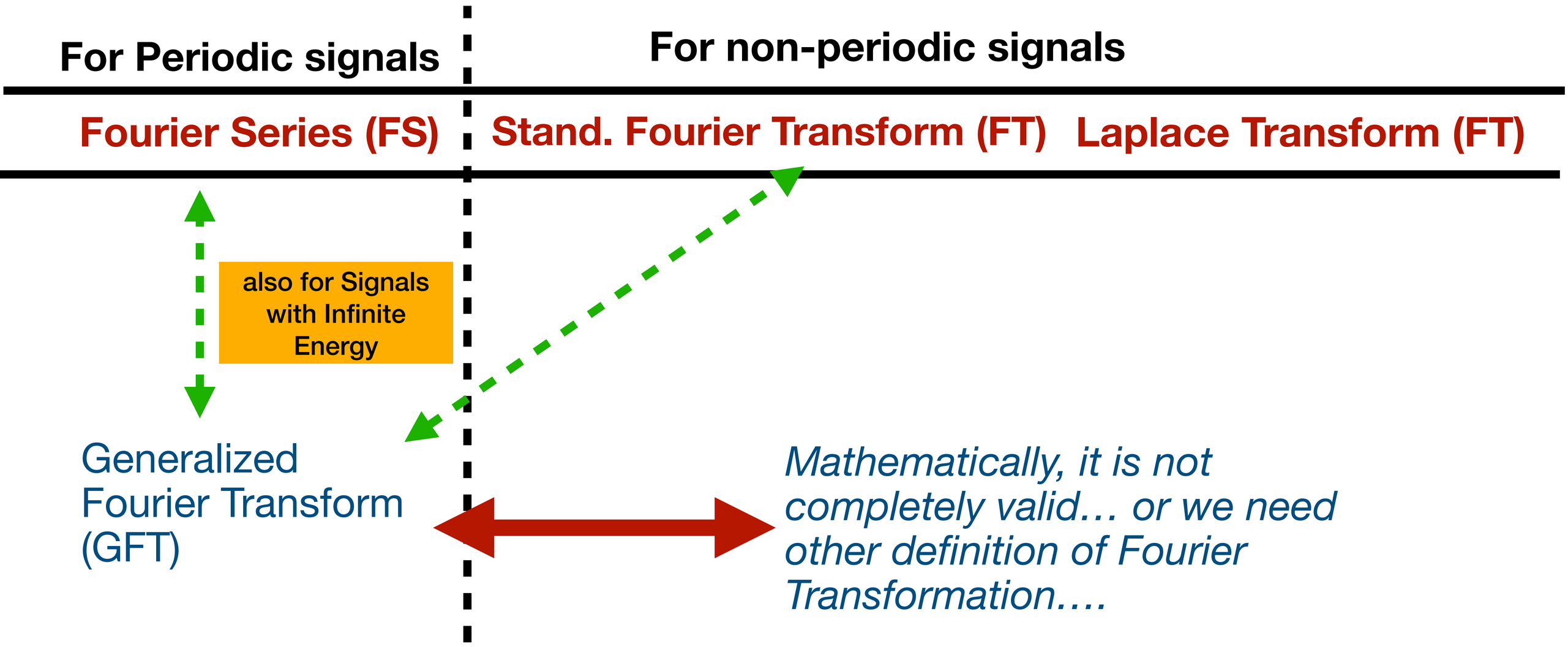
For a periodic signal? transformed domain?

- **For periodic signals ===> Fourier series (FS)**
- *… and the **Generalized Fourier Transform (GFT)***
- *but it is the "same" that of the Fourier Series for periodic signals….*
- all the information is contained in the FS (with GFT nothing new, for periodic signals)

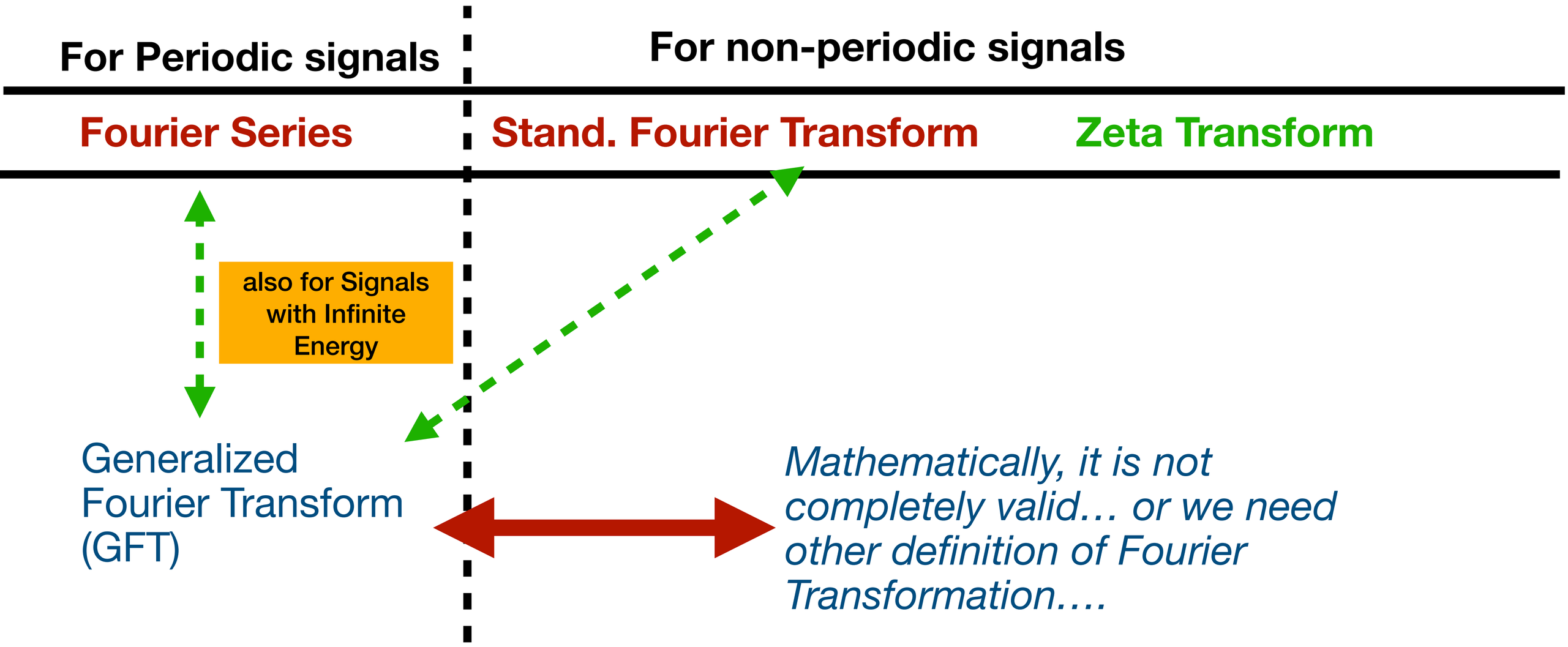
For a periodic signal? transformed domain?

- **Historically, the Fourier Series was the first tool introduced…**

Transformations for signals in continuous time



Transformations for signals in discrete time



Next?

- the Fourier Series (FS) for signals in continuos time

Questions?