

# Laplace Transforms and their Applications

## About the Laplace Transformation

The Laplace Transformation (named after [Pierre-Simon Laplace](http://en.wikipedia.org/wiki/Pierre-Simon_Laplace) ([http://en.wikipedia.org/wiki/Pierre-Simon\\_Laplace](http://en.wikipedia.org/wiki/Pierre-Simon_Laplace))) is a useful mathematical tool that is used in many branches of engineering including signals and systems theory, control theory, communications, mechanical engineering, etc.

Its principle benefits are:

- it enables us to represent differential equations that model the behaviour of systems in the time domain as polynomials in  $s$  which facilitates their solution
- it converts time convolution (which is how we determine the time-response of a system to a given signal) into a simple multiplication in the  $s$  domain
- it allows us to model linear time-invariant (LTI) system components using transfer functions and systems by block diagrams
- block diagram analysis allows us to readily compute system responses to complex signals.

The only downside is that time  $t$  is a real value whereas the Laplace transformation operator  $s$  is a complex exponential  $s = \sigma + j\omega$ .

In this section of the course we will cover:

- The Laplace Transformation
- The Inverse Laplace Transform
- Using Laplace Transforms for Circuit Analysis
- Transfer Functions
- Impulse Response and Convolution

## Colophon

- The source code for this page is [content/laplace\\_transform/index.md](https://github.com/cpjobling/eg-247-textbook/blob/master/content/laplace_transform/index.md) ([https://github.com/cpjobling/eg-247-textbook/blob/master/content/laplace\\_transform/index.md](https://github.com/cpjobling/eg-247-textbook/blob/master/content/laplace_transform/index.md)).
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