The Islamia University of Bahawalpur

**U**niversity **C**ollege of **E**ngineering **&T**echnology **D**epartment of **C**omputer **S**ystem **E**ngineering

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| **LAB MANUAL** | **SIGNALS AND SYSTEMS EE-311** | **5thSemester** |

**LAB EXPERIMENT # 10**

**Inverse Laplace transform in MATLAB**

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| **Student Name: Laiba Saleem** | **Roll No: 20-CSE-09** |
| **Lab Instructor Signatures:** | **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

# OBJECTIVE:

* To Generate and plot the inverse Laplace transformation in MATLAB.

**Inverse Laplace Transforms with MATLAB:**

You can compute inverse Laplace transform using the symbolic toolbox of MATLAB. If you want to compute the inverse Laplace transforms. The two−sided or bilateral inverse Laplace Transform pair is defined as

L-1FS = ft ∫ Fs estds

where the integration is done along the vertical line Re(*s*) = *γ* in the [complex plane](https://en.wikipedia.org/wiki/Complex_plane) such that *γ* is greater than the real part of all [singularities](https://en.wikipedia.org/wiki/Mathematical_singularity) of *F*(*s*) and *F*(*s*) is bounded on the line, for example if contour path is in the [region of convergence.](https://en.wikipedia.org/wiki/Region_of_convergence) If all singularities are in the left half- plane, or *F*(*s*) is an [entire function](https://en.wikipedia.org/wiki/Entire_function) , then *γ* can be set to zero and the above inverse integral formula becomes identical to the [inverse Fourier transform.](https://en.wikipedia.org/wiki/Inverse_Fourier_transform)

In practice, computing the complex integral can be done by using the [Cauchy residue theorem.](https://en.wikipedia.org/wiki/Cauchy_residue_theorem)

**Example 1: Find inverse laplace Using MATLAB**



**Code:**

>>Syms t s

>>F=(s-5)/(s\*(s+2)^2)

>>ilaplace(F)

**Output:**

ans= -5/4+(7/2\*2\*t+5/4)\*exp(-2\*t)

The [Laplace transform](https://en.wikipedia.org/wiki/Laplace_transform) and the inverse Laplace transform together have a number of properties that make them useful for analysing [linear dynamical systems](https://en.wikipedia.org/wiki/Linear_dynamical_system).

An integral formula for the inverse [Laplace transform,](https://en.wikipedia.org/wiki/Laplace_transform) called the *Mellin's inverse*

*formula*,the [*Bromwich*](https://en.wikipedia.org/wiki/Thomas_John_I%27Anson_Bromwich) *integral*, or the [*Fourier*](https://en.wikipedia.org/wiki/Joseph_Fourier)*–[Mellin](https://en.wikipedia.org/wiki/Hjalmar_Mellin) integral*, is given by the [line integral](https://en.wikipedia.org/wiki/Line_integral): Two integrable functions have the same Laplace transform only if they differ on a set of [Lebesgue measure](https://en.wikipedia.org/wiki/Lebesgue_measure) zero. This means that, on the range of the transform, there is an inverse transform. In fact, besides integrable functions, the Laplace transform is a [one-to-one](https://en.wikipedia.org/wiki/One-to-one_function) mapping from one function space into another in many other function spaces as well, although there is usually no easy characterization of the range. Typical function spaces in which this is true include the spaces of bounded continuous functions, the space [*L*∞(0, ∞)](https://en.wikipedia.org/wiki/Lp_space), or more generally [tempered functions](https://en.wikipedia.org/w/index.php?title=Tempered_function&action=edit&redlink=1) (that is, functions of at worst polynomial growth) on (0, ∞). The Laplace transform is also defined and injective for suitable spaces of [tempered distributions](https://en.wikipedia.org/wiki/Distribution_(mathematics)#Tempered_distributions_and_Fourier_transform).

In these cases, the image of the Laplace transform lives in a space of [analytic functions](https://en.wikipedia.org/wiki/Analytic_function) in the [region of convergence.](https://en.wikipedia.org/wiki/Laplace_transform#Region_of_convergence) The [inverse Laplace transform](https://en.wikipedia.org/wiki/Inverse_Laplace_transform) is given by the following [complex](https://en.wikipedia.org/wiki/Complex_number) integral, which is known by various names (the Bromwich integral, the Fourier–Mellin integral, and Mellin's inverse formula):

# Example:2

**Code:**

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num=[1 2];

den=[1 5 6]; [r,p,k]=residue(num,den)

**OUTPUT**:

r =

2.0000

-1.0000

k=[]

p =

-3.0000

-2.0000

**Tasks:**

# Solve and compare them with MATLAB results. Find the inverse Laplace.

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# Solve and compare them with MATLAB results. Find inverse Laplace.