PRACTICAL - 5

Practical: Plotting Graphs of Various Functions Using SciLab

Aim:

To plot the graphs of trigonometric functions (sin(x) and cos(x)), exponential function (e^x), absolute function (|x|), and inverse and hyperbolic functions (tanh(x) + acos(x)) using SciLab.

Materials Required:

- SciLab software (version 6.1 or higher) for executing mathematical computations and visualizations.

- A computer system with SciLab installed to perform the plotting operations.

- Basic understanding of mathematical functions and their graphical representations.

Theory (In Detail):

Mathematical functions play a crucial role in engineering, physics, and computer science. Visualizing these functions helps in understanding their behavior across different ranges. SciLab provides built-in capabilities to plot various mathematical functions such as trigonometric, exponential, absolute, inverse, and hyperbolic functions.

1. **Trigonometric Functions:** Trigonometric functions are periodic functions that describe oscillatory motion. The sine function (sin(x)) and cosine function (cos(x)) oscillate between -1 and 1, having a periodicity of 2π. They are widely used in physics, engineering, and signal processing.

2. **Exponential Function (e^x):** The exponential function represents rapid growth or decay and is given by y = e^x, where e is Euler's number (approximately 2.718). It is commonly used in population growth, financial models, and physics.

3. **Absolute Function (|x|):** The absolute value function returns the magnitude of a number, always yielding a non-negative result. Mathematically, it is defined as |x| = x if $x \geq 0$ and |x| = -x if $x < 0$. The graph has a 'V' shape with a vertex at the origin, which makes it useful in optimization problems.

4. **Hyperbolic and Inverse Functions (tanh(x) + acos(x)):** The hyperbolic tangent function (tanh(x)) is similar to the sigmoid function and is defined as: tanh(x) = (e^x - e^(-x)) / (e^x + e^(-x)). It is widely used in artificial intelligence and machine learning. The inverse cosine function (acos(x)) gives the angle whose cosine is x, with a domain restriction of $-1 \leq x \leq 1$.

Formulas Required:

1. Trigonometric Functions: y = sin(x), y = cos(x)

2. Exponential Function: y = e^x

3. Absolute Function: y = |x|

4. Hyperbolic & Inverse Functions: y = tanh(x) + acos(x)

Applications:

- **Trigonometric Functions:** Used in physics, engineering, sound waves, and oscillations.
- **Exponential Functions:** Used in finance, population growth modeling, and physics.
- **Absolute Function:** Used in optimization problems and error measurements.
- **Hyperbolic Functions:** Used in machine learning, neural networks, and physics.

Result:

The graphs of trigonometric, exponential, absolute, inverse, and hyperbolic functions were successfully plotted using SciLab. The obtained graphs helped visualize the mathematical properties of these functions.