

# Functions

To return a hyperbolic cosecant of a given value. This function operates Element-wise on matrices.

 **Note**

- **x** and **y** represent real values or variables.
- **c** and **d** represent complex values or variables.
- **m** and **n** represent integer values or variables.
- **U** represents a matrix of values.
- A matrix can be passed to a function that operates Element-wise on matrices, as its argument in the example as follows

```
X = [1, -2, 3; -4, 5, -6; 7, -8, 9];  
  
Y = abs(X)  
result:  
Y = [1 2 3; 4 5 6; 7 8 9]
```

| Function name | Syntax               | Function                                                                                                                                                |
|---------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| abs           | abs(x)<br>abs(c)     | To return an absolute value of x or a complex modulus of c. This function operates Element-wise on matrices.                                            |
| acos          | acos(x)<br>acos(c)   | To return an arc cosine of an angle in the range of 0.0 through pi. All angles are measured in radians.This function operates Element-wise on matrices. |
| acosc         | acosc(x)<br>acosc(c) | To return an inverse cosine of a given value expressed in degrees. This function operates Element-wise on matrices.                                     |
| acosh         | acosh(x)<br>acosh(c) | To return an inverse hyperbolic cosine of a given value. This function operates Element-wise on matrices.                                               |
| acot          | acot(x)<br>acot(c)   | To return an inverse cotangent of a given value. This function operates Element-wise on matrices.                                                       |
| acotd         | acotd(x)<br>acotd(c) | To return an inverse cotangent of a given value expressed in degrees. This function operates Element-wise on matrices.                                  |
| acoth         | acoth(x)<br>acoth(c) | To return an inverse hyperbolic cotangent of a given value. This function operates Element-wise on matrices.                                            |
| acsc          | acsc(x)<br>acsc(c)   | To return an inverse cosecant of a given value. This function operates Element-wise on matrices.                                                        |
| acscd         | acscd(x)<br>acscd(c) | To return an inverse cosecant of a given value expressed in degrees. This function operates Element-wise on matrices.                                   |
| acsch         | acsch(x)<br>acsch(c) | To return an inverse hyperbolic cosecant of a given value. This function operates Element-wise on matrices.                                             |
| asec          | asec(x)<br>asec(c)   | To return an inverse secant of a given value. This function operates Element-wise on matrices.                                                          |
| asecd         | asecd(x)<br>asecd(c) | To return an inverse secant of a given value expressed in degrees.This function operates Element-wise on matrices.                                      |
| asech         | asech(x)<br>asech(c) | To return an inverse hyperbolic secant of a given value. This function operates Element-wise on matrices.                                               |

|       |                            |                                                                                                                                                                                                                                    |
|-------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| asin  | asin(x)<br>asin(c)         | To return an arc sine of an angle in the range of $-\pi/2$ through $\pi/2$ . This function operates Element-wise on matrices.                                                                                                      |
| asind | asind(x)<br>asind(c)       | To return an inverse sine of a given value expressed in degrees. This function operates Element-wise on matrices.                                                                                                                  |
| asinh | asinh(x)<br>asinh(c)       | To return an inverse hyperbolic sine of a given value. This function operates Element-wise on matrices.                                                                                                                            |
| atan  | atan(x)<br>atan(c)         | To return an arc tangent of an angle in the range of $-\pi/2$ through $\pi/2$ . This function operates Element-wise on matrices.                                                                                                   |
| atan2 | atan2(x, y)<br>atan2(U, V) | To return an arc tangent of an angle in the range of $-\pi$ through $\pi$ . atan2(U, V) returns a matrix of the same size as the U and V matrices containing the Element-by-Element, inverse tangent of the real parts of U and V. |
| atand | atand(x)<br>atand(c)       | To return an inverse tangent of a given value, expressed in degrees. This function operates Element-wise on matrices.                                                                                                              |
| atanh | atanh(x)<br>atanh(c)       | To return an inverse hyperbolic tangent of a given value. This function operates Element-wise on matrices.                                                                                                                         |
| ceil  | ceil(x)                    | To return a smallest (closest to negative infinity) value that is not less than the value of x and is equal to a mathematical integer. This function operates Element-wise on matrices.                                            |
| col   | col(U, m)                  | To return a specific column values of a given matrix. U is a square matrix, m is a column index (starts at 0).                                                                                                                     |
| conj  | conj(c)                    | To return a conjugated value of c. This function operates Element-wise on matrices.                                                                                                                                                |
| cos   | cos(x)<br>cos(c)           | To return a trigonometric cosine of an angle. This function operates Element-wise on matrices.                                                                                                                                     |
| cosd  | cosd(x)<br>cosd(c)         | To return a cosine of a given value expressed in degrees. This function operates Element-wise on matrices.                                                                                                                         |
| cosh  | cosh(x)<br>cosh(c)         | To return a hyperbolic cosine of a given value. This function operates Element-wise on matrices.                                                                                                                                   |
| cot   | cot(x)<br>cot(c)           | To return a cotangent of a given value. This function operates Element-wise on matrices.                                                                                                                                           |
| cotd  | cotd(x)<br>cotd(c)         | To return a cotangent of a given value expressed in degrees. This function operates Element-wise on matrices.                                                                                                                      |
| coth  | coth(x)<br>coth(c)         | To return a hyperbolic cotangent of a given value. This function operates Element-wise on matrices.                                                                                                                                |
| count | count(U)                   | To return a number of Elements of a given matrix.                                                                                                                                                                                  |
| csc   | csc(x)<br>csc(c)           | To return a cosecant of a given value. This function operates Element-wise on matrices.                                                                                                                                            |
| cscd  | cscd(x)<br>cscd(c)         | To return a cosecant of a given value expressed in degree. This function operates Element-wise on matrices.                                                                                                                        |
| csch  | csch(x)<br>csch(c)         | To return a hyperbolic cosecant of a given value. This function operates Element-wise on matrices.                                                                                                                                 |
| det   | det(U)                     | To return a determinant of a given matrix. U is a square matrix.                                                                                                                                                                   |

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|---------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| diag          | diag(U)<br>diag(U, m)                                | To return a diagonal matrix and diagonals of the matrix. If U is a row matrix or a column matrix of n Elements, this function will return a square matrix of order $n+abs(m)$ , with the Elements of U on the kth diagonal. $k = 0$ represents the main diagonal. $k > 0$ is above the main diagonal. $k < 0$ is below the main diagonal. If U is a square matrix, this function will return a column matrix formed by the Elements of the kth diagonal of U. |
| exp           | exp(x)<br>exp(c)                                     | To return a Euler's number e raised to the power of a or c. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                  |
| eye           | eye(m)                                               | To return an identity matrix of dimension m x m.                                                                                                                                                                                                                                                                                                                                                                                                              |
| factorial     | factorial(m)                                         | To return a factorial of m value.                                                                                                                                                                                                                                                                                                                                                                                                                             |
| floor         | floor(x)<br>floor(c)                                 | To return a largest (closest to positive infinity) value that is not greater than the value of x and is equal to a mathematical integer. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                     |
| IEEEremainder | IEEEremainder(x, y)                                  | To compute the remainder operation in two arguments as prescribed by the IEEE 754 standard.                                                                                                                                                                                                                                                                                                                                                                   |
| if            | if(b,x,y)                                            | To return the value of x if b is true. Otherwise, y is returned. Where b is a boolean value.                                                                                                                                                                                                                                                                                                                                                                  |
| imag          | imag(c)                                              | To return a real value of an imaginary part of a given complex number. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                       |
| invert        | invert(U)                                            | To return an inverse or pseudo inverse of a given matrix. If the given matrix is a square matrix, the inverse of a U matrix will be returned using the LU factorization. If the given matrix is not a square matrix, a pseudo inverse matrix will be returned using the QR factorization.                                                                                                                                                                     |
| linsolve      | linsolve(U,V)                                        | $X = \text{linsolve}(U,V)$ solves the linear system $U*X = V$ using the LU factorization with partial pivoting when U is a square matrix.                                                                                                                                                                                                                                                                                                                     |
| ln            | ln(x)<br>ln(c)                                       | To return a natural logarithm (base e) of a given value. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                     |
| log           | log(x)<br>log(c)                                     | To return a natural logarithm (base e) of a given value. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                     |
| log10         | log10(x)<br>log10(c)                                 | To return a logarithm base 10 of a given value. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                              |
| log2          | log2(x)<br>log2(c)                                   | To return a logarithm base 2 of a given value. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                               |
| max           | max(x, y,...)<br>max(c, d,...)<br>max(U)<br>max(U,V) | To return a greater of the given values. max(U) returns the largest Element of a given matrix. max(U, V) returns a matrix the same size as U and V with the largest Elements taken from U or V. The dimensions of U and V must be the same.                                                                                                                                                                                                                   |
| mean          | mean(U)                                              | To return a mean or average value of a given matrix. U is a row or a column matrix: mean(U) returns the mean value of all Elements in the given matrix. U is a 2-D matrix: mean(U) returns a row matrix that contains the mean value of each column of the given matrix.                                                                                                                                                                                      |
| median        | median(U)                                            | To return a median value of a given matrix. U is a row or column matrix: median(U) returns the median value of all Elements in the given matrix. U is a 2-D matrix: median(U) returns a row matrix that contains the median value of each column of the given matrix.                                                                                                                                                                                         |
| min           | min(x, y,...)<br>min(c, d,...)<br>min(U)<br>min(U,V) | To return a smaller of the given values. min(U) returns the smallest Element of a given matrix. min(U, V) returns a matrix the same size as U and V with the smallest Elements taken from U or V. The dimensions of U and V must be the same.                                                                                                                                                                                                                 |

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| num2str | num2str(x)<br>num2str(c)            | To return a string specifying a given number x.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| ones    | ones(m, n)                          | To return an m x n matrix of all 1s.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| pow     | pow(x, y)<br>pow(U, c)<br>pow(c, d) | To return a value of the first argument raised to the power of the second argument. This function operates Element-wise on a given matrix U.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| random  | random()                            | To return a real value with a positive sign, greater than or equal to 0.0 but less than 1.0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| real    | real(c)                             | To return a real value of the real part of a given complex number. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| rint    | rint(x)                             | To return a value that is closest in value to an argument and is equal to a mathematical integer. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| round   | round(x)                            | To return a closest value to an argument and is equal to a mathematical integer. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| row     | row(U, m)                           | To return a specific row values of a given matrix. U is a square matrix, m is a row index (starts at 0).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| sec     | sec(x)<br>sec(c)                    | To return a secant of a given value. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| secd    | secd(x)<br>secd(c)                  | To return a secant of a given value expressed in degree. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| sech    | sech(x)<br>sech(c)                  | To return a hyperbolic secant of a given value. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| sin     | sin(x)<br>sin(c)                    | To return a trigonometric sine of an angle. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| sind    | sind(x)<br>sind(c)                  | To return a sine of a given value, expressed in degree This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| sinh    | sinh(x)<br>sinh(c)                  | To return a hyperbolic sine of a given value. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| size    | size(U)<br>size(U, m)               | To return a size of a given matrix. If only the matrix is passed to the function as an argument, the returned value is a 1x2 matrix. The first Element is the number of rows and the second Element is the number of columns. If the second parameter (m) is specified, this function will return the size of an mth dimension of a given matrix as a scalar value. The second argument can be 1 or 2 (1 for the row size and 2 for the column size). For example:<br>U = [1, 2, 3; 4, 5, 6];<br>size(U) is [2, 3]<br>size(U, 1) is 2<br>size(U, 2) is 3                                                                             |
| sort    | sort(U)<br>sort(U, 'descend')       | To sort the Elements of a given matrix in an ascending or descending order. If the second argument is specified with 'ascend' or 'descend', the Elements will be in an ascending or descending order respectively. If this function is called without a second argument, the Elements will be sorted in an ascending order.<br>U is a row or column matrix:<br>sort(U) and sort(U, ascend) sort all Elements in the given matrix.<br>U is a 2-D matrix: sort(U) and sort(U, ascend) sort Elements in each column of the given matrix.                                                                                                |
| ssqrt   | sqrt(x)<br>sqrt(c)                  | To return a correctly rounded positive square root of a double value. This function operates Element-wise on matrices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| std     | std(U)<br>std(U, flag)              | To return a standard deviation of a given matrix. The 'flag' argument can be 0 or 1. It specifies the method for calculating the standard deviation.<br>If the flag = 0, the standard deviation is normalized by N-1. If the flag = 1, the standard deviation is normalized by N where N is the number of data.<br>The value of the flag will be zero by default. U is a row or column matrix:<br>std(U) and std(U, flag) returns the standard deviation of all Elements in the given matrix. U is 2-D matrix: std(U) and std(U, flag) returns a row matrix that contains the standard deviation of each column of the given matrix. |
| str2num | str2num(s)                          | To return a number specified by a given string s.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| sum     | sum(U)                              | To return a summation of all Elements in a U matrix.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|           |                              |                                                                                                                                                    |
|-----------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| tan       | tan(x)<br>tan(c)             | To return a trigonometric tangent of an angle. This function operates Element-wise on matrices.                                                    |
| tand      | tand(x)<br>tand(c)           | To return a tangent of a given value expressed in degree.This function operates Element-wise on matrices.                                          |
| tanh      | tanh(x)<br>tanh(c)           | To return a hyperbolic tangent of a given value. This function operates Element-wise on matrices.                                                  |
| toDegrees | toDegrees(x)<br>toDegrees(c) | To convert an angle measured in radians to an approximately equivalent angle measured in degrees.This function operates Element-wise on matrices.  |
| toRadians |                              | To convert an angle measured in degrees to an approximately equivalent angle measured in radians. This function operates Element-wise on matrices. |
| transpose | transpose(U)                 | To return a transposition of a given matrix                                                                                                        |
| zeros     | zeros(m,<br>n)               | To return an m x n matrix of all 0s.                                                                                                               |