

Intersection of Two Lines

MATLAB Implementation

Tamas Kis | kis@stanford.edu

TAMAS KIS
<https://github.com/tamaskis>

Copyright © 2021 Tamas Kis

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.



Contents

1	Download and Installation	4
1.1	Download from MATLAB File Exchange	4
1.2	Download from GitHub	4
1.3	Files Included With Download	4
1.4	Accessing the <code>line_intersection</code> Function in a MATLAB Script	4
2	<code>line_intersection</code>	5
3	Intersection of Two Lines	7

1 Download and Installation

1.1 Download from MATLAB File Exchange

The `line_intersection` function is available for download on MATLAB® Central's File Exchange at https://www.mathworks.com/matlabcentral/fileexchange/85428-intersection-of-two-lines-line_intersection.

1.2 Download from GitHub

The `line_intersection` function is available for download on GitHub® at https://github.com/tamaskis/line_intersection-MATLAB.

1.3 Files Included With Download

There are **five** files included in the downloaded zip file:

1. `EXAMPLE.M` – *example for using the `line_intersection` function*
2. `Intersection of Two Lines - MATLAB Implementation.pdf` – *this PDF*
3. `LICENSE` – *license for the `line_intersection` function*
4. `line_intersection.m` – *MATLAB function to find the intersection of two lines*
5. `README.md` – *markdown file for GitHub documentation*

1.4 Accessing the `line_intersection` Function in a MATLAB Script

There are **four** options for accessing the `line_intersection` function in a MATLAB script:

1. Copy the `line_intersection` function to the *end* of your MATLAB script.
2. Place the `line_intersection.m` file in the same folder as the MATLAB script.
3. Place the `line_intersection.m` file into whatever folder you want, and then use the `addpath(folderName)` command¹ where the `folderName` parameter is a string that stores the filepath of the folder that `line_intersection.m` is in *relative to* the folder that your script is in.
4. Make a toolbox by first opening `line_intersection.m`, then going to the HOME tab in MATLAB, and finally selecting Package > Toolbox in the drop-down menu under Add-Ons. Once you package the `line_intersection` function as a toolbox, you can use it in any script.

¹ <https://www.mathworks.com/help/matlab/ref/addpath.html>

2 line_intersection

Syntax

```
[x,y] = line_intersection([m1,b1],[m2,b2])  
[x,y] = line_intersection([x1,y1,m1],[x2,y2,m2])
```

Description

`[x,y] = line_intersection([m1,b1],[m2,b2])` returns the intersection (x,y) of two lines given in slope-intercept form:

1. $y_1 = m_1x + b_1$
2. $y_2 = m_2x + b_2$

`[x,y] = line_intersection([m1,b1],[m2,b2])` returns the intersection (x,y) of two lines given in point-slope form:

1. $y - y_1 = m_1(x - x_1)$
2. $y - y_2 = m_2(x - x_2)$

Example

Example 2.1

Find the intersection of $y = 5x + 2$ and $y - 4 = 7(x - 10)$.

■ **SOLUTION**

To find the intersection point, we just have to note that for the first line, we have $m_1 = 5$ and $b_1 = 2$, while for the second line, we have $x_2 = 10$, $y_2 = 4$, and $m_2 = 7$.

```
% line 1 parameters  
m1 = 5;  
b1 = 2;  
  
% line 2 parameters  
x2 = 10;  
y2 = 4;  
m2 = 7;
```

```
% finds intersection point  
[x_int,y_int] = line_intersection([m1,b1],[x2,y2,m2])
```

This yields the result

```
x_int =
```

```
34
```

```
y_int =
```

```
172
```

3 Intersection of Two Lines

Consider the following two lines given in point-slope form:

$$y - y_1 = m_1 (x - x_1)$$

$$y - y_2 = m_2 (x - x_2)$$

If these two lines intersect at $(x_{\text{int}}, y_{\text{int}})$, then

$$y_{\text{int}} - y_1 = m_1 (x_{\text{int}} - x_1) \quad (1)$$

$$y_{\text{int}} - y_2 = m_2 (x_{\text{int}} - x_2) \quad (2)$$

Solving Eqs. (1) and (2) for y_{int} ,

$$y_{\text{int}} = y_1 + m_1 (x_{\text{int}} - x_1) \quad (3)$$

$$y_{\text{int}} = y_2 + m_2 (x_{\text{int}} - x_2) \quad (4)$$

Equating Eqs. (3) and (4),

$$y_1 + m_1 (x_{\text{int}} - x_1) = y_2 + m_2 (x_{\text{int}} - x_2)$$

Solving for x_{int} ,

$$x_{\text{int}} = \frac{(m_1 x_1 - m_2 x_2) - (y_1 - y_2)}{m_1 - m_2} \quad (5)$$

To obtain y_{int} , we can use either line. We choose to use line 1.

$$y_{\text{int}} = y_1 + m_1 (x_{\text{int}} - x_1) \quad (6)$$