Scripts to find the transfer function of a wave probe and its hysteresis

Script features:

-Calculates the transfer functions for a wave gauge being calibrated, the calibration process is referred in Chapter IV thesis's.

-Ir calculates the transfer function for a calibration process where the wave probe its inserted at its length (l0) one then is moved 1 meter inside the tank by moving it every 10 cm in.

-Wave transfer functions are calculated inserting the wave probe in to the tank and moving them outside in the same process.

-Possible differences between the measured data due to hysteresis are plotted and its difference is calculated, also the standard deviation of the obtained data is calculated to measure possible sensor malfunction.

What is need it:

-Data collected in (x,y) as (depth of immersion, voltage measured) is need it, data its feed into the arrays manually to be calculated.

What can be done:

-The script is straightforward and can be used on python, C, Wolfram language, Matlab or any other programming language.

1st block:

Voltage and depth of immersion are set into arrays, and then whet are transposed to create an (x,y) list. The data is then formatted into a Table and also plotted.

```
voltaged = {v0, v10, v20, v30, v40, v50, v60, v70,
v80, v90};
```

```
heightd = {0, 10, 20, 30, 40, 50, 60, 70, 80, 90};
dataxyd = Transpose[{voltaged, heightd}];
datad = TableForm[Tablexyd = Table[dataxyd]]
ad = ListPlot[dataxyd]
```

2nd block:

The data is fitted into a linear function as, our physical range of depths must satisfy a linear relationship for the sensor to be easy to read. The function fitted is then plotted and is compared to the data obtained in the tank.

```
std = Fit[dataxyd, {1, x}, x]
add = Plot[{std}, {x, 0, 100}]


Show[{add, std}]
```

3rd block:

The same process if done for the wave probe as it is retrieved from the tank.

```
voltaged2 = {v02, v102, v202, v302, v402, v502, v602,
v702, v802,
   v902};
heightd2 = {0, 10, 20, 30, 40, 50, 60, 70, 80, 90};
dataxyd2 = Transpose[{voltaged2, heightd2}];
datad2 = TableForm[Tablexyd2 = Table[dataxyd2]]
ad2 = ListPlot[dataxyd2]
```

```
std2 = Fit[dataxyd2, {1, x}, x]
add2 = Plot[{std2}, {x, 0, 100}]

Show[{add2, std2}]
```

4th block:

The difference between the voltage measured is calculated and it is transposed to the respective measured depths, this to create a list of the voltage lecture difference between the calibration by immersion and the calibration by substraction. The standard deviation is calculated to search for any large dispersion on the measured voltages.

```
Dif = Abs[voltaged2 - voltaged]
heightd = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9};
Transpose[{heightc, Dif}]
StandardDeviation[Dif]
```