DEWESoft™
measurement innovation

Rosette Math Plugin

Document-Version: 1.0.0
Plugin-Version: 2.2

www.dewesoft.com

Table of Contents

1Installation....1
1.1Download....1
1.2Compatibility....1
1.3Licensing....1
1.4Plug-in Installation....1
1.5Where to find in DEWESoft....1
2Introduction....2
2.1Usage....2
2.2Physical basics....2
3The Plugin....4
3.1Inputs....4
3.2Output parameters....4
3.3Used formulas....5
3.3.1Configuration 45°....5
3.3.2Configuration 60°....5
3.3.3Configuration 120°....5
4Measurement....6
4.1Demo Example....6
4.2Check of results....7
5FAQ....8
5.1No output....8
6Version History....10
6.1Plugin Version....10
6.2Documentation Version....10

1 Installation

The plugin is installed by default with the DEWESoft fullinstaller, please check for the latest version on the webpage.

1.1 Download

- DEWESoft™ homepage
  http://www.dewesoft.com
  You can download the latest DEWESoft™ plugin when you go to: Support → Downloads → Plugins

1.2 Compatibility

The plugin is compatible with DEWESoft™ *7.0.5, 7.1* and DEWESoft™ *X*.

It has been tested on Windows 7 (32-bit and 64-bit).

1.3 Licensing

No extra license is needed.

1.4 Plug-in Installation

Simply copy the file `Rosettes.mth` over the existing one into the `Addons` folder of your DEWESoft™ installation. (e.g. `D:\DEWESoft7\Bin\V7_1\Addons\`) and then start DEWESoft™.

1.5 Where to find in DEWESoft

The plugin will be shown as a seperate icon in the Math section in channel setup.

The Math section should be activated by default, if not: go to Settings → Hardware Setup → Math and activate the checkbox “Basic functions”.

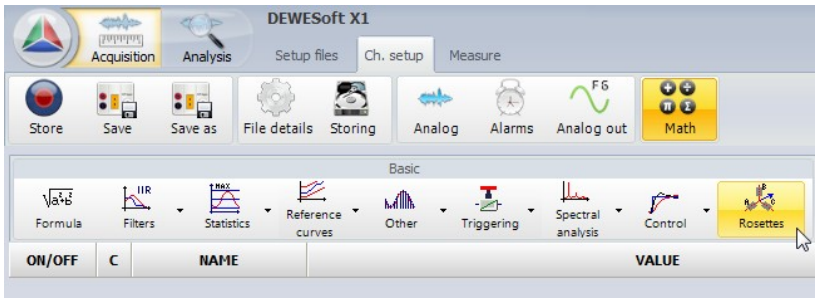

Illustration 1: Where to find

2 Introduction

2.1 Usage

The Rosette Math plugin is used to determine the angle and max amplitude of strain/stress on a surface. This is used when it is not known which direction of the strain/stress has to be expected. Without the plugin lots of calculations would have to be done manually in Math, therefore it is of great help.

Rosette strain gauges are available combined in one foil (stacked construction), alternatively you can use three separate strain gauges (planar construction).

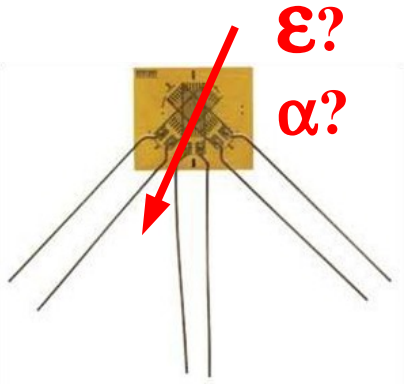

Illustration 2: rosette strain gauge in stacked construction

2.2 Physical basics

A few words about the difference between strain and stress.

Strain

is the mechanical deformation measured as a relation between length change relative to initial length:

$\varepsilon = dL / L$

[µm/m]

The strain is usually presented in um/m, so the ratio of elongation in micrometers comparing to the length of a specimen in meters. So what does that really mean if we measured a value of 2000? First of all, we can also express this in percent. Strain in um/m divided by 10000 is elongation in percent. In the case of 2000, the elongation will be 0.2%.

We can also judge from this value how close the material is from its limit of elasticity. For steel, this limit is app. 2% (this depends heavily on the type of steel), so were exceed 20000 um/m, the specimen would be over its tolerance of elasticity and would be permanently stretched.

Stress

is defined as the average force per unit area, also taking the material into account.

$\sigma = F / A$

[N/mm²]

Young's modulus

The formulas above only work in the linear part of the "strain-stress-curve" shown below. In this area there is a constant factor between stress and strain

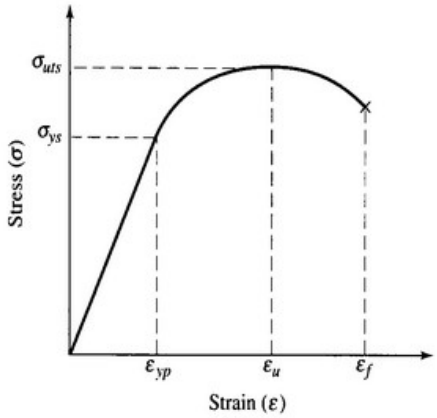

Illustration 3: strain-stress curve

$E = \sigma / \varepsilon$

where E is the Young's modulus or Elastic modulus, depending on the used material (e.g. steel = 210 kN/mm2).

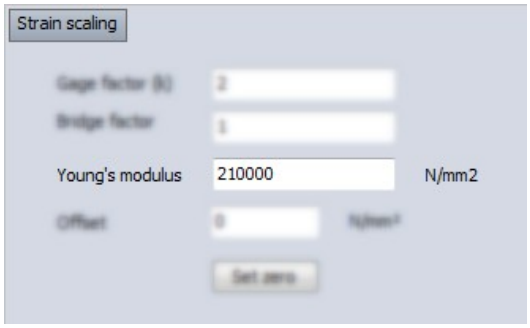

Illustration 4: Young's modulus in DEWESoft

The measured value from the strain gage is therefore the strain and you get the stress by calculating $\sigma = \varepsilon \cdot E$

In DEWESoft this factor is shown in channel setup, when setting the amplifier to bridge mode and changing physical quantity to "Stress".

3 The Plugin

3.1 Inputs

The plugin requires three strain gauge input channels (Epsilon A, B and C) and the angular rosette alignment (45°, 60°, 120°). Using three elements instead of two (Tee rosette) minimizes the effect of error due to misalignment to the two elements from the physical axis. Furthermore, the bigger the angle between the gauges, the better the result (less influence of noise).

The physical quantity of the inputs can either be strain OR stress; NO conversion is done inside the plugin. So all the calculations also work if you input stress instead of strain channels. Please only ensure that all three are the same physical dimension.

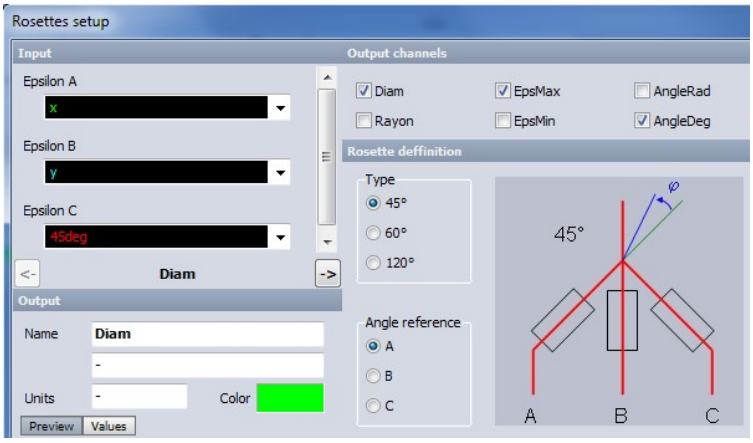

Illustration 5: Rosettes plugin setup

3.2 Output parameters

The plugin uses the Mohr's circle for calculation, the according parameters are listed in brackets().

Diam … average strain (center of Mohr's circle)

Rayon … max shear strain (radius of Mohr's circle)

EpsMax … Max strain in angle direction (Diam + Rayon)

EpsMin … Min strain in angle+90° direction (Diam – Rayon)

AngleRad … angle of max strain (in radiant)

AngleDeg … angle of max strain (in degrees)

3.3 Used formulas

3.3.1 Configuration 45°

Diam = (EpsA + EpsC) / 2

Rayon = 1/sqrt(2) * sqrt((EpsA - EpsB)^2 + (EpsB - EpsC)^2)

EpsMax = DataDiam + DataRayon

EpsMin = DataDiam - DataRayon

Angle(rad) = 1/2 * ArcTan((2*EpsB - EpsA - EpsC) / (EpsA - EpsC))

3.3.2 Configuration 60°

Diam = (EpsA + EpsB + EpsC) / 3

Rayon = sqrt(2)/3 * sqrt((EpsA - EpsB)^2 + (EpsB - EpsC)^2 + (EpsA - EpsC)^2)

EpsMax = DataDiam + DataRayon

EpsMin = DataDiam - DataRayon

Angle(Rad) = 1/2 * ArcTan((sqrt(3) * (EpsB - EpsC)) / (2* EpsA - EpsB - EpsC))

3.3.3 Configuration 120°

Diam = (EpsA + EpsB + EpsC) / 3

Rayon = sqrt(2)/3 * sqrt((EpsA - EpsB)^2 + (EpsB - EpsC)^2 + (EpsA - EpsC)^2)

EpsMax = DataDiam + DataRayon

EpsMin = DataDiam - DataRayon

Angle(Rad) = 1/2 * ArcTan((sqrt(3) * (EpsB - EpsC)) / (2*EpsA - EpsB - EpsC))

4 Measurement

4.1 Demo Example

Below is a demo example, where Math channels in DEWESoft are used as inputs for the Rosettes plugin. Please consider, that the plugin is not able to work with Math channels of type “single value”, therefore you have to change the Math channel time base to Sync, or just add a little noise to your Math channels (+0,01*noise) to make them look alive.

In this example the inputs A, B and C can be additionally changed by channels from the Control Channels plugin (green sliders).

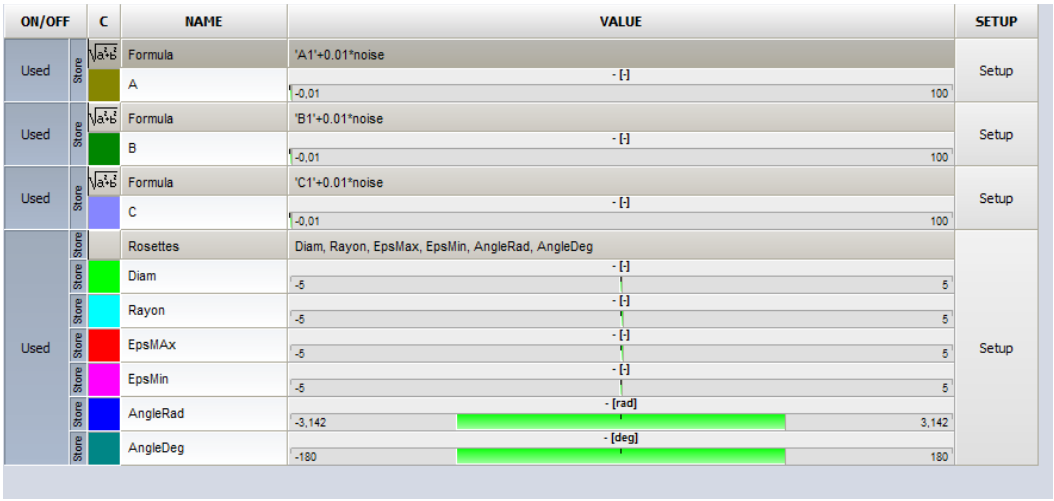

Illustration 6: Rosettes plugin setup

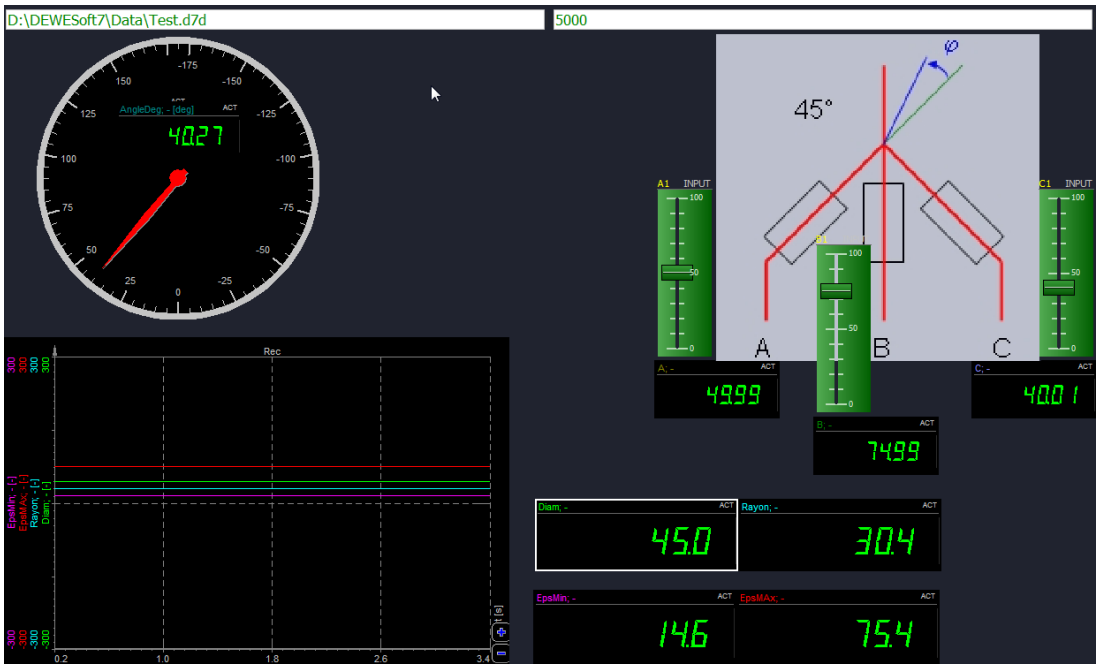

Illustration 7: Example DEWESoft measure screen

4.2 Check of results

Here the software “MDSolids” is used for checking the results. As you can see with the same input parameters you get the same result.

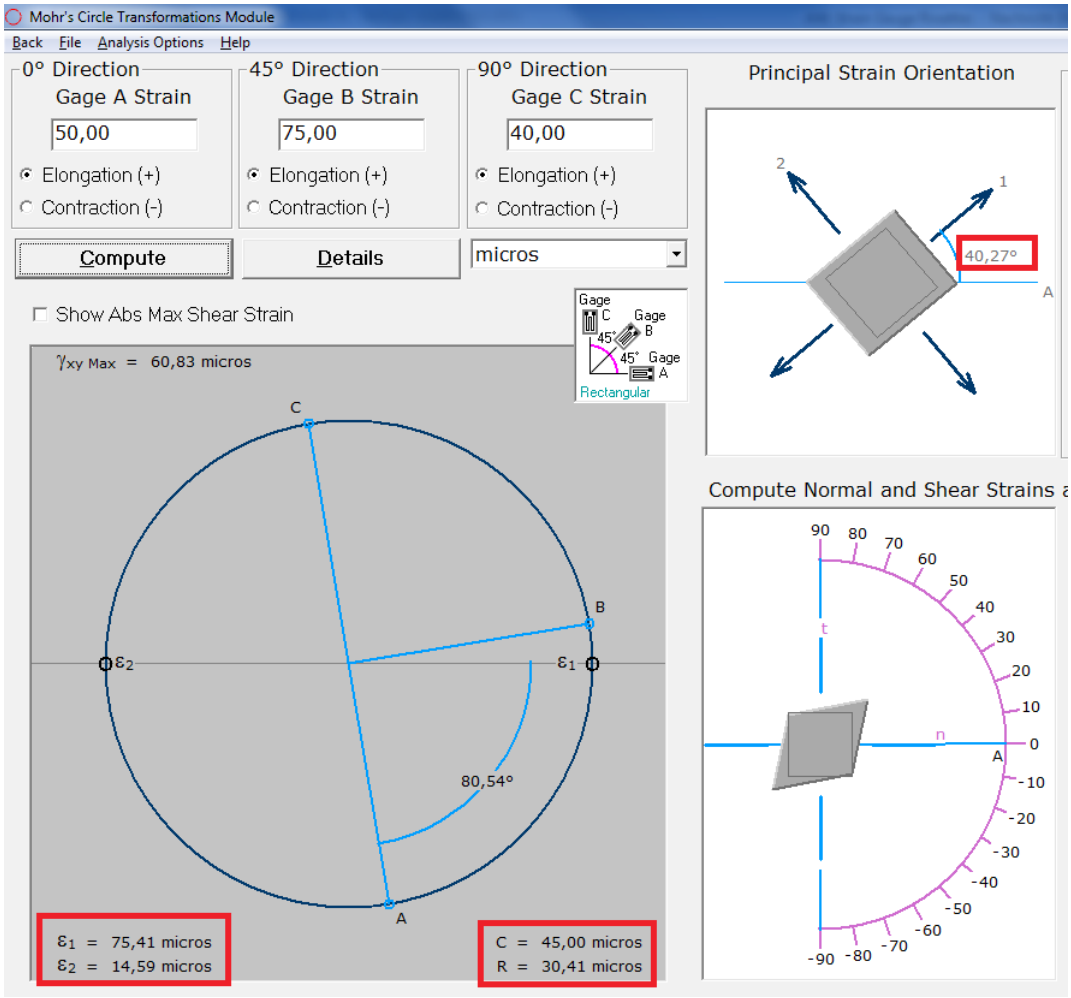

Illustration 8: Checking with MDSolids (on the left side you can see Mohr's circle)

5 FAQ

This section should help to find quick solutions for known problems.

5.1 No output

Problem: No output if using plugin with demo channel (fix Math values like 50, 100, ...)

Solution: Please consider, that the plugin is not able to work with Math channels of type “single value”, therefore you have to change the Math channel time base to Sync (see screenshot below), or just add a little noise to your Math channel (+0,01*noise) to make them look alive.

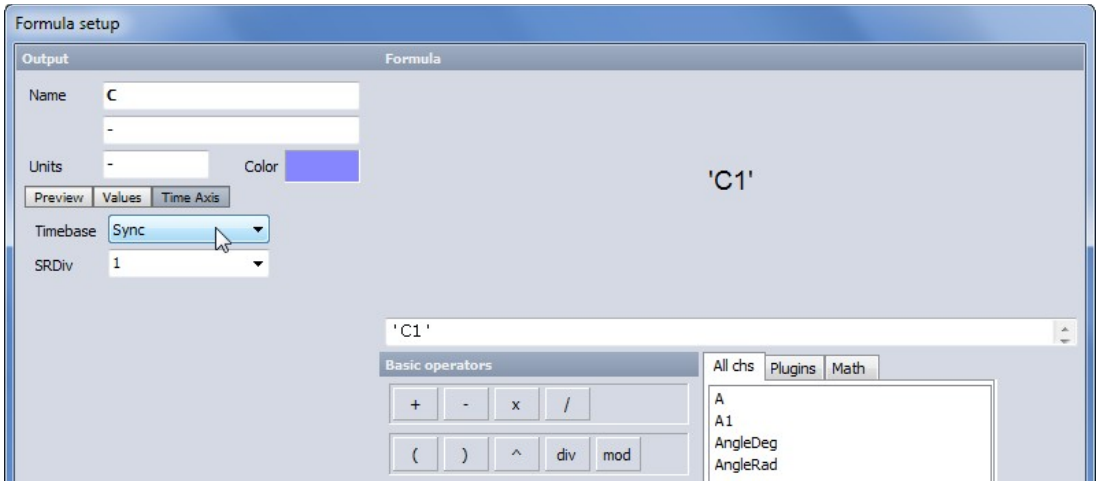

Illustration 9: Change timebase of Math channel

6 Version History

6.1 Plugin Version

Plugin-Version	Date [dd.mm.yyyy]	Notes
2.2	28.05.13	

6.2 Documentation Version

Revision number: 37
Last modified: Tue 04 Jun 2013, 17:12

Doc-Version	Date [dd.mm.yyyy]	Notes
1.0.0	04.06.13	initial revision for plugin version 2.2