TwinCalc

1.5
user guide

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Introduction

TwinCalc is a Windows application for stress analysis based on calcite twinning using most of available methods as well as new ones. For theoretical background click here. TwinCalc was coded in Object-Pascal using some libraries by doc. Melichar, Masaryk University Brno (www.ugv.cz) and graphic library GR32 (www.graphics32.org). All plots are in Lambert projection, lower hemisphere and are available as bitmaps and metafiles.

TwinCalc can be used and distributed only for non-commercial purposes!

The main form of TwinCalc contains the main menu, two toolbars and sub-forms with results and settings of all available methods, one sub-form for each one. Horizontal toolbar contains tools for data and graphics management, vertical toolbar tools for stress analysis. TwinCalc can open only one data file, so if you want to work with more than one at the same time, you will have to run several TwinCalcs (warning, do not run more than one total-search analysis, because it is a multi-threaded process and it would take longer running several at once then running one after another).
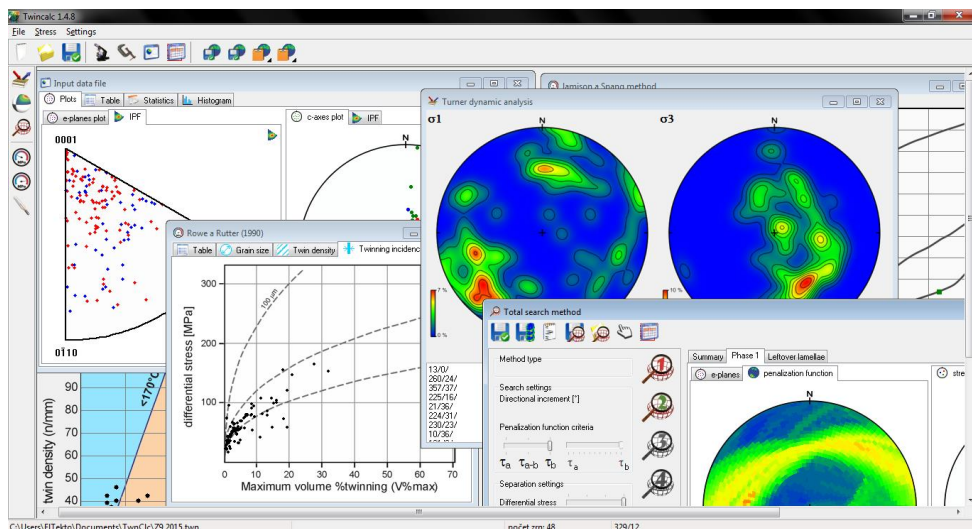
When TwinCalc is started, an opening panel appears (↓). The user has three options how to continue: open an existing file, create a data file by entering U-stage data or generate a data file numerically. Main toolbars appear after pressing one of these buttons.

Toolbars

Horizontal toolbar contains tools for data and graphics management and matches the File pane in the main menu. There are two of each button for saving graphics which can be used to save plots from the active sub-form: the left one for the left plot, the right one for the right plot. TwinCalc will disable one of the pair if there is only one plot on the sub-form.

new file – deletes all data, deactivates all tools and resets all settings

load a *.twn file

save the data in TwinCalc *.twn format.

input U-stage data

generate data file numerically

plot the data file and its basic statistics

analyse/compare stress tensors of different data files

save right or left plot of active sub-form as a bitmap or metafile (can be changed in the dialog box)

copy the right or left plot into clip-board; the color of the clip-board indicates format of the plot: orange for bitmap, yellow for metafile;

the type can be changed by clicking on the black triangle in the bottom right corner on the button

Vertical toolbar contains stress analysis tools and matches the Stress pane in the main menu.

Turner dynamic analysis

right-dihedra method

total-search method

Jamison & Spang method

Rowe & Rutter method

Ferrill et al. method (thermometer)

Data management tools

Input data file

When TwinCalc data file *.twn is opened, Input data file sub-form appears. This form can be displayed any time by 🔲 button on the horizontal toolbar. The data is plot as IP and IPF plots of *e*-planes poles and *c*-axes in the Plots tab. IPF plots can be contoured by clicking on 🔺 button in the top right corner of the plot (after the first click appears an edit box with smoothing coefficient – the higher the number, the sharper the maxima; to run the calculation, press the button again). All points in the plots are color coded: *e*-planes are distinguished to twinned and untwined, *c*-axes according to the number of twin plane sets of the grain. The color code can be shown by pressing 🔵 in the bottom right corner of the plot. Other tabs contain a table of data, some basic statistics of the data file and a grain size histogram.
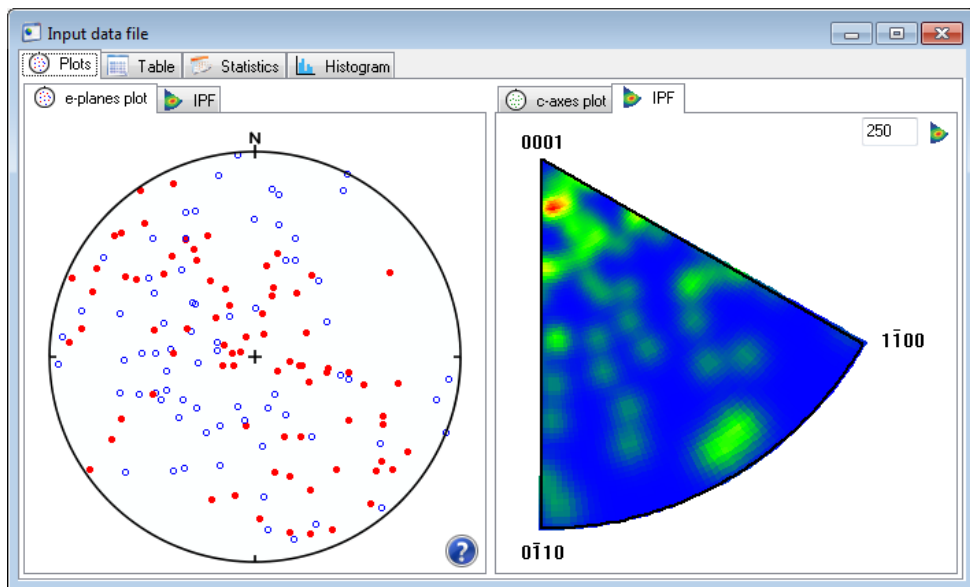
Data file generator

TwinCalc contains a data set generator for testing purposes. Data can be generated with numerous different settings and then deformed infinitely by subsequent stress tensors.
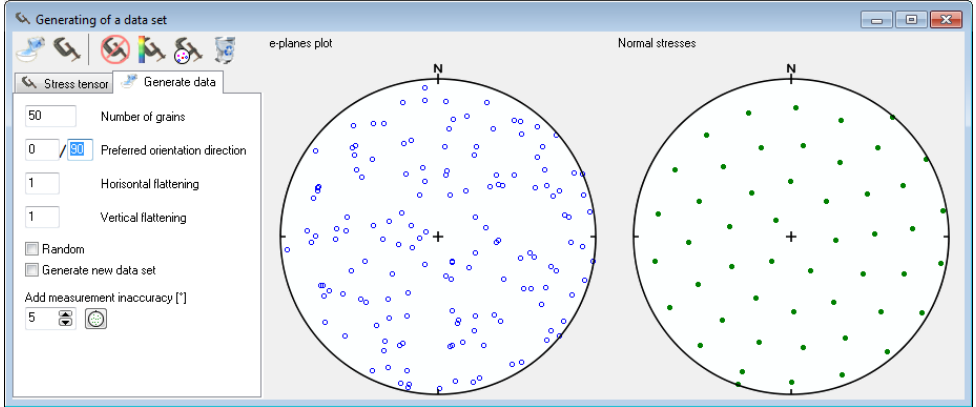

button generates a data file according to settings on Generate data tab (figure ↑). The user can set the number of grains, direction and degree of preferred orientation of grains and finally the method of *c*-axes generation – with perfectly uniform or random distribution (☐ Random). Measurement error can be introduced into the data file by pressing ⊙. *c*-axes can be input also directly by left-clicking into the *c*-axes plot (*e*-planes are generated randomly).

button applies chosen stress tensor on the data. Parameters of the stress tensor can be set in the Stress tensor tab. σ_1, σ_2 and σ_3 directions can be input directly by clicking into the Normal stresses plot. σ_2 magnitude can be input in MPa or using shape parameter Φ[1] in the edit box right to the σ_2 magnitude edit box (press enter to calculate the stress). Deformation of the data set can be repeated infinitely, only make sure that ☐ Generate new data set is not checked, otherwise a new data set would be generated every time. Reactivated lamellae will be plot in green (↓).

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[1] $\Phi = \sigma_2 - \sigma_3 / \sigma_1 - \sigma_3$

Other buttons on the tool-bar are used for a deeper analysis of the data set. ⊘ button undeforms data. ⓚ button applies the stress tensor on the data and colors the *e*-plane poles according to shear stress acting along the glide vector *g* of the *e*-plane (the color legend can be displayed by ⓠ button in the bottom right corner of the plot). ⓢ button highlights incompatible untwined *e*-planes by violet color (similar to the Total-search form). ⓑ button deletes the whole data file.
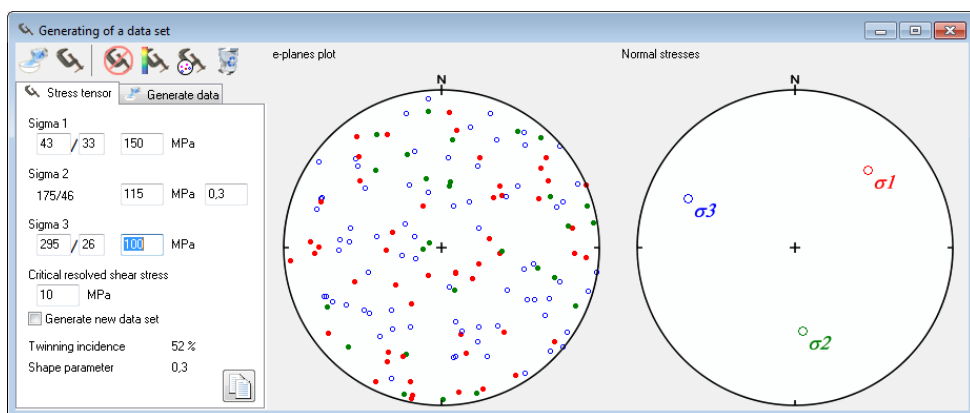

Input U-stage data

This form is the basic tool to input and edit real data measured using a universal stage. The use of a U-stage was described for example by Turner & Weiss (1963)[2]. The sub-form has 5 basic sections: Input data, Settings, import, diagram and Input data check.

All measurements are input into edit boxes in the Input data section, N and H axes readings first; in the case of *c*-axis, the user has to indicate whether the grain was in polar (0 or p) or equatorial (1 or e) orientation (i.e. whether the *c*-axis was vertical or horizontal-parallel to the K axis). The grain size is in mm, mean thickness of lamellae in microns! The user can use the enter key to jump to the next edit box. The measurements are

[2] Turner, F. J. & Weiss, L. E. 1963. *Structural analysis of metamorphic tectonites*. McGraw-Hill book company, Inc.

processed and added to the data file after pressing one of ![button] buttons, first, second or third one according to the number of twin-systems in the grain. If a grain is untwined but has visible cleavage, its orientation can be also measured (the same way as *e*-planes) and input by pressing button ![button] (do not confuse with a microlamella! these two can be distinguished by *c*-axis/*e*-plane angle). Even untwined grains are important for the stress analysis!
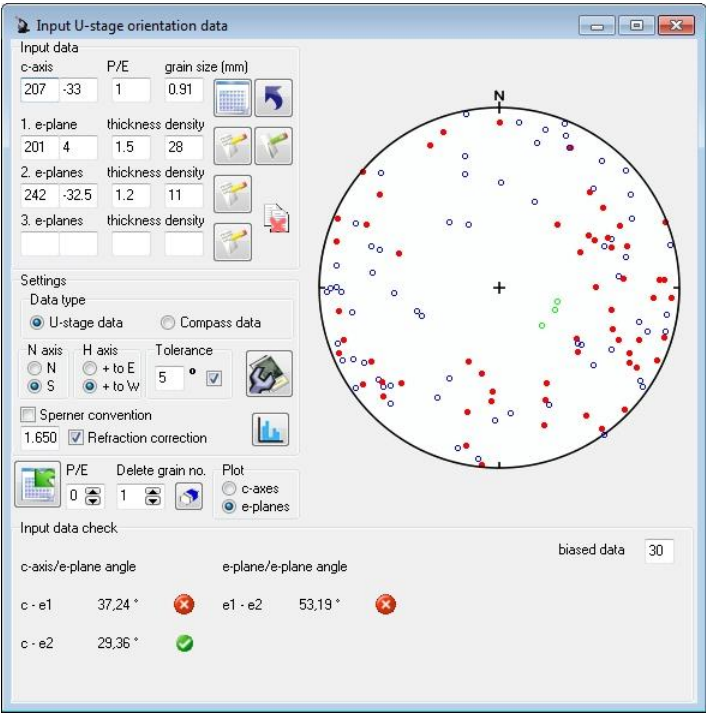
After pressing the appropriate button, the readings are converted to vectors according to the Settings. The most important thing is to set the orientation of N-axis and H-axis convention (help can be displayed by right-clicking on the H axis label). These settings are absolutely crucial for the calculation, so be very careful! In literature and user guides of various U-stage manufactures exist several designations of U-stage axes, most common is N H K (other U-stage axes are not necessary for the stress

analysis purposes). The N-axis is vertical with clockwise reading and is used to measure trends, whereas the north-south trending H-axis measures plunges. The plunges may vary between -90° to 90°, which means the user has to determine, whether he considered during measuring the rotation around H-axis dextral (the angle is positive when the tilting is clockwise – the table tilts towards E; + to E setting; figures B and D ↓) or sinistral (the angle is positive if the tilting is anti-clockwise - the table tilts towards W; + to W setting; figures A and C ↓). You have to note the convention somewhere (ideally directly into the table with measurements), keep it throughout the whole measurement and set it correctly in the Settings panel. The H axis trends towards the "north" or the "south" (in the coordinate system of the U-stage; in the figure ↓ left trends towards the north) which has to be set correctly in the H axis panel. Set the convention correctly! The settings + to E and + to W are in the coordinate system of the H axis, not the U-stage! See figure below to prevent any confusion. Plunges of *e*-planes and of *c*-axes in equatorial orientation are calculated as a complement to 90°. TwinCalc calculates this automatically but if the user has already precalculated data (e.g. when using some semi-automatic U-stages) it is possible to block this step by checking ☐ Sperner convention.
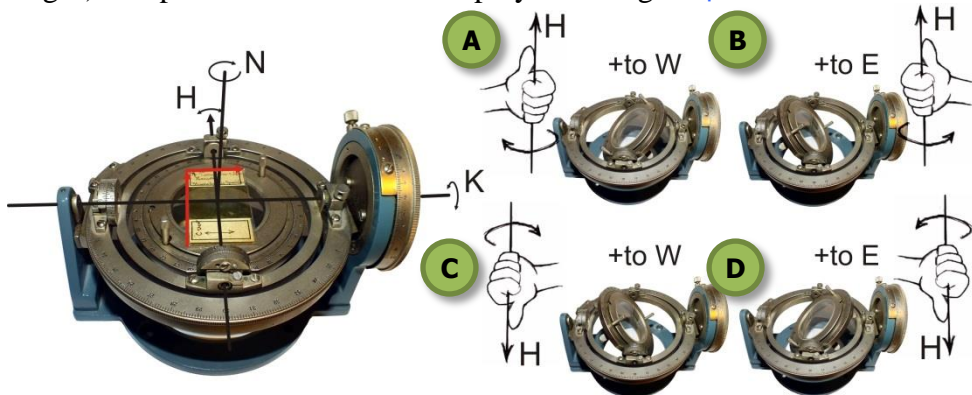
If ☐ Refraction correction is checked, TwinCalc corrects the readings (enter the refraction coefficients of segments you used!). As a last step TwinCalc calculates angels between *c*-axis and *e*-twins and e-twins themselves and writes them into the Input data check panel. If the angles are

within given Tolerance, a green icon ✅ is shown next to it. If the angles are incorrect, a red one is shown (❌). Finally, if the angle is near 44.5°, which is the angle between *c*-axis and *r*-plane (cleavage), TwinCalc warns the user by a yellow triangle ⚠. If the plunge of the c-axis is too steep, there is a danger of overlooking a twinned system. If the dip of a calculated e-plane exceeds the threshold set in edit box biased data, TwinCalc warns the user by this yellow rectangle ⚠. It is therefore recommended to use TwinCalc during data acquisition, to check measurement errors and where necessary redo the measurement. A histogram of measurement errors can be displayed by 📊 button. 🔙 button can be used to delete the last measurement, if the error is too big (can be used repeatedly). *c*-axes and *e*-planes vectors are then orthogonalised (using the least-square technique favouring less-error-prone *e*-planes), added to the data file, plotted and added to the data table (including the original angles for later qc). This table can be shown by 🔲 button (you can get back to the Input data check panel by clicking 🔳 button). It is also recommended to note the measurements elsewhere, e.g. into an excel table. TwinCalc can copy the measurements into clip-board, to save the user more typing. This function is not active by default (TwinCalc does nothing without the user's knowledge as a rule) and can be activated by clicking 🔴 button, which icon changes to 📝, indicating, that the tool is activated. To deactivate the tool, press the button again. Format of the data copied into clip-board is the same as in the excel table Form.xls, which can be downloaded together with TwinCalc.
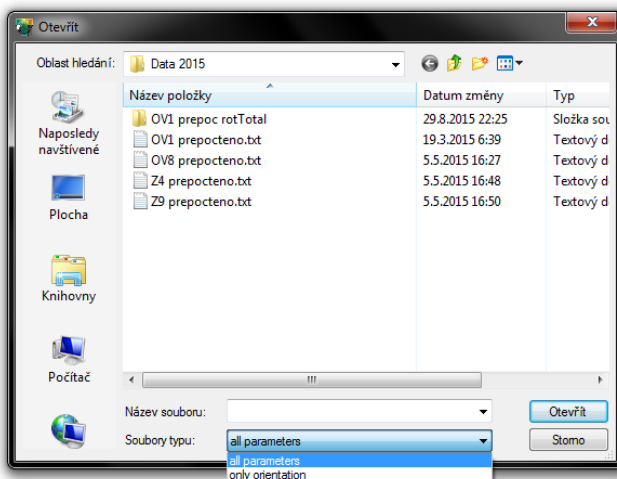
Already calculated Euler-angles of the data (trend/plunge of the c-axes and of normals to e-planes) can be input directly into edit boxes, however, the user has to check the ◎ Compass data in the Data type panel. It is not a problem when additional data is not available (grain size, thickness of lamellae etc.), however, methods depending on such data could not be done.

Data can be also imported from a text file by pressing 📑 button (make sure that all settings are correct before importing data!). It is possible to import data with all parameters (with grain sizes, thicknesses etc.) or just orientations of c-axes and e-planes (the user has to choose either the option in the dialog box file type filter; fig. ↑). One grain on one line, the measurements have to be separated by tabs and the file must not have a header! Data format with all parameters has to be as follows (it matches the format of Form.xls which can be downloaded together with TwinCalc):

Nc Hc E/P v.z.[1] Ne_1 He_1 m^2 h^3 r/e[4] Ne_2 He_2 m^3 h^4 Ne_3 He_3 m^3 h^4

[1] grain size in mm
[2] twin thickness in microns
[3] twin density in n/mm
[4] e – twin lamella; r – cleavage

example:

```
105 22  e    0.4 138 37  0.7 21  e    103 -1   0.4 17
58  -29 e    0.5 43  -42 0   0   r
352 14  e    0.7 20  32  1.1 18  e    345 0    0.4 20  320 32  0.7 13
```

The only orientation data format is as follows:

Nc Hc E/P Ne_1 He_1 r/e[1] Ne_2 He_2 Ne_3 He_3

[1] e – twin lamella; r – cleavage

example:

105	22	e	138	37.5		e	103	-1		
58	-29	e	43	-42		r				
352	14	e	20	32		e	345	0	320	32

Measurement error qc can be done in the data table (▦), in which the last two columns show angles between *c*-axis and *e*-plane normal and between *e*-planes normals. If some grain shows too big of an error, it can be deleted by ▣ button. It is necessary to set the number of the grain to be deleted in the edit box next to the ▣ button or by clicking directly into the table on one of three lines belonging to the grain.

So far the data was input in the coordinate system of the thin-section. The data can be rotated into geographic coordinate system on a panel that appears after pressing ▣ button (left figure ↓). Thin-section orientation is given by two **vectors** − the short and the long side of the thin-section, which are highlighted by two black arrows (↓) and are set! It is strongly recommended to mark the vectors directly on the thin-section e.g. by staining appropriate thin-section edge with a permanent marker to avoid any confusion when the measurement has to be paused or repeated. Euler
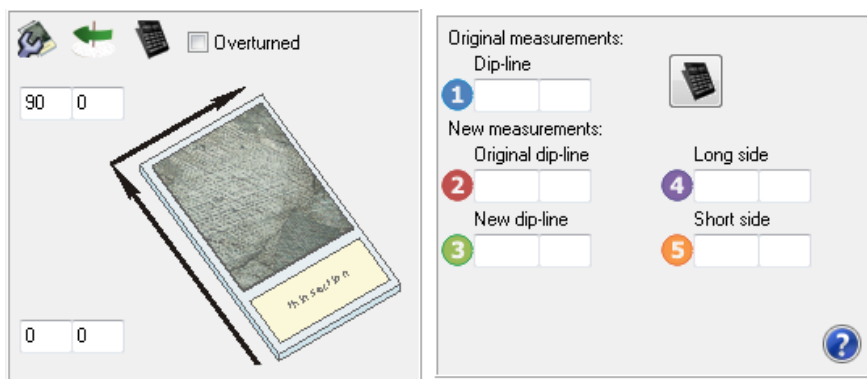

vectors (trend/plunge) of said vectors can be set in edit boxes next to the arrows (note since these axes are vectors, the plunges can be negative, i.e. pointing up!). If the thin-section is overturned the user has to indicate this by checking ☐ Overturned. TwinCalc notifies the user if the orientation seems overturned and the check-box is not checked. The orientation is set by clicking ▣ button on the panel. After this moment all data will be automatically rotated into geographic coordinates, the orientation must be

set before the measurement not during. Alternatively, the user can input all data in thin-section coordinate system and rotate the data set after finishing all measurements (the user is encouraged to do it this way to avoid any confusion when the measurement is paused or repeated). The data is rotated by clicking ⬅ button.

📱 button opens another panel that is used to calculate the long and short thin-section vectors. This tool is a little complicated, because it is designed to manage the worst case orientation of the sample and thin-section. It is of course better to take the sample with the orientation of the thin-section already in mind (e.g. perpendicular it the foliation parallel with lineation) to make everything easier. The measurement can be done by orienting the sample in the lab exactly as it was in the outcrop (fixing it using some putty) hence measuring the vectors directly. If this is impossible, the user can fix the sample in any orientation and measure four vectors: the long and the short vector of the thin-section (**4** and **5** ↓), orientation of the plane that was used to orient the sample (as a dip-line!; **3**) and finally the original dip-line marked on the sample in the field as a lineation (**2**; see figure ↓). These four measurements plus the measurement from the field (dip-line!; **1**) have to be entered into edit boxes on the panel. If the user managed to orient the sample the same way as it was in the field, edit boxes 1-3 will have the same numbers (orientation of the sample in the field − 1). Note that all these measurements are vectors! It means that if any of them point upwards and were measured by a compass (which yields a downward pointing vector), they have to be flipped, either by hand or using
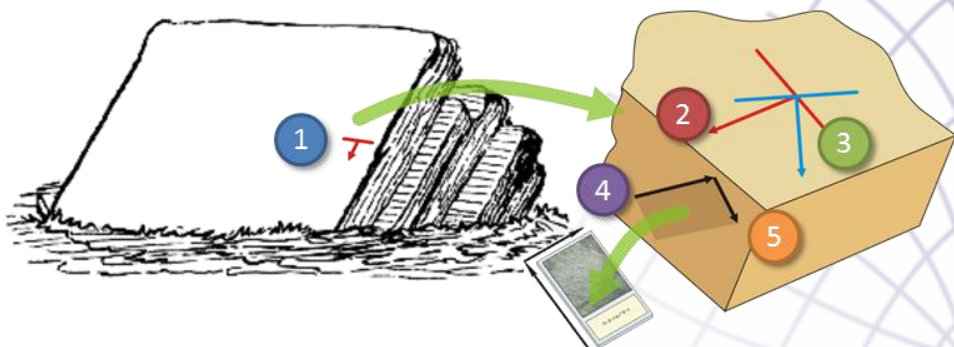
appropriate ⊟ button. The calculation is done by 🔖 button on the panel. Resulting vectors are input in appropriate edit boxes. Hereafter follow the instructions above.

Stress phases analysis

Tools of this sub-form enable the user analysis of stress phases of different data sets. Euler angles of main normal stresses (trend/plunge) and shape ratio Φ separated by tabs are the input for the analysis:

Phase annotation $\alpha_{\sigma1}$ $\phi_{\sigma1}$ $\alpha_{\sigma2}$ $\phi_{\sigma2}$ $\alpha_{\sigma3}$ $\phi_{\sigma3}$ Φ

Stress tensors in such format can be inputs either directly into the text window in the left part of the sub-form or by loading a TwinCalc *.ttwn file saved earlier (see below). Any number of files can be added (one by one) by 🔖 button. If the phase names are too long, they can be trimmed by checking ☐ Trim names.

When all stress tensors are added in the text window, press 🖼 button. TwinCalc calculates 9D-vectors of all stress tensors and angles between all of them[3], outputs them into a table, plots the normal stresses (either σ_1 and σ_2 or σ_1 and σ_3, according to the setting in the Plots tab), and performs a rudimentary cluster analysis (Clusters tab). First and second order cluster limits can be set in edit boxes in the upper part of the tab or directly by click into the graph – left-clicking sets the first order clusters limit, right-clicking the second order ones. The limits can be displayed as vertical lines by checking ☐ Indicate limits. The graph can be drawn either in one color (black by default, but it can be changed by right-clicking on ☐ Color clusters) or every cluster in different color (by checking ☐ Color clusters).

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[3] Kernstocková, M. 2011. Paleonapjatostní analýza polyfázově reaktivovaných zlomů na příkladu barrandienu. MS, Dizertační práce, Přírodovědecká fakulta Masarykovy univerzity, Brno.
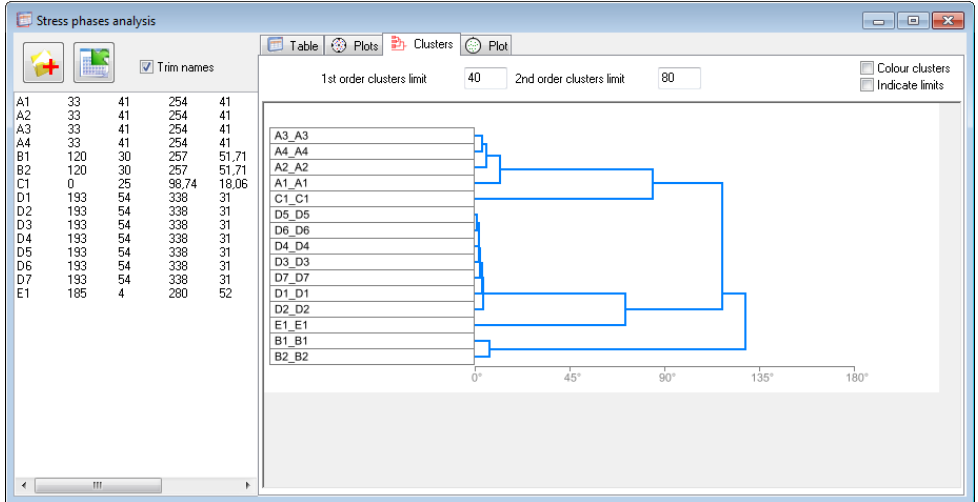
The last panel (Plot) is used for he final sorting of stress tensors into phases and plotting production quality diagrams. Stress tensors are sorted into phases based on angles between stress tensor 9D vectors. Phases are initially defined using 1st order cluster limit from the Clusters panel and displayed in the treeview in the left part of the Plot panel. Every tensor is assigned a unique color, every phase is assigned the color of the first tensor of the phase. Default phase names are **Phase 1** etc. which can be changed in the treeview just like renaming a file in Windows. Color of every tensor can be changed in a pop-up menu displayed by right clicking on a tensor (figure ↓). The phase color can be only changed by changing the color of the first tensor of the phase. Stress tensor assignment to o phase can be changed in the same pop-up menu. Target phase is selected in a combo-box and the selection is confirmed by pressing ➡ button (figure ↓). Last button of the list creates a new phase. All empty phases are deleted automatically.

Stress tensors to be plotted can be turned off and on by check-boxes in the treeview. All tensors of a phase can be turned on and off by the phase check-box. Normal stresses to be plotted can be turned on and off in the Plot panel. Symbol of each normal stress can be set by ◄► buttons next to it. Symbol colors can be set in the Color by panel. Either tensor colors, phase colors, shape ratio colors or normal stresses colors can be used.

Color of each normal stress is indicated by the color of appropriate normal stress symbol. It can be changed by left clicking on the symbol. Symbol size can be changed using the Size spin-edit, label font by f button. Labels of normal stresses can be set by ☐ Label check-box. Left click toggles stress tensor names, right click toggles σ_1, σ_2 and σ_3 annotations. Plot legend is set by two check-boxes ☐ ☐ Legend. Left check-box toggles color legend, right check-box toggles symbol legend.
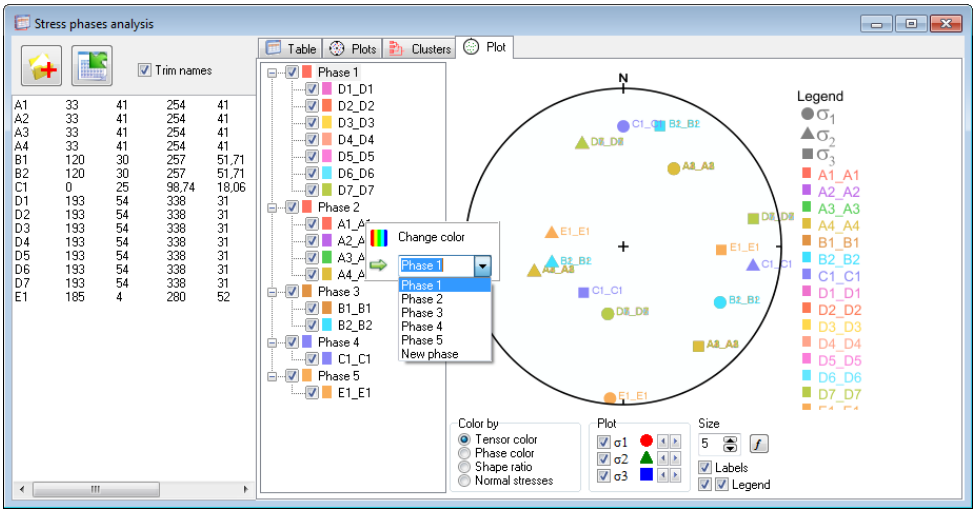
Stress analysis tools

These tools can be used after creating or loading a data file and can be found either in the main menu (Stress) or in the left vertical toolbar on the main form.

Turner dynamic analysis

Turner dynamic analysis sub-form appears after clicking ![icon] button and the calculation is run immediately. Compression and extension axes are plotted and written into text windows in the bottom part of the sub-form. The plots can be contoured by clicking on the Contour button. Smoothing of the Watson distribution can be set in the edit box below the button, the higher the number, the sharper the maxima.
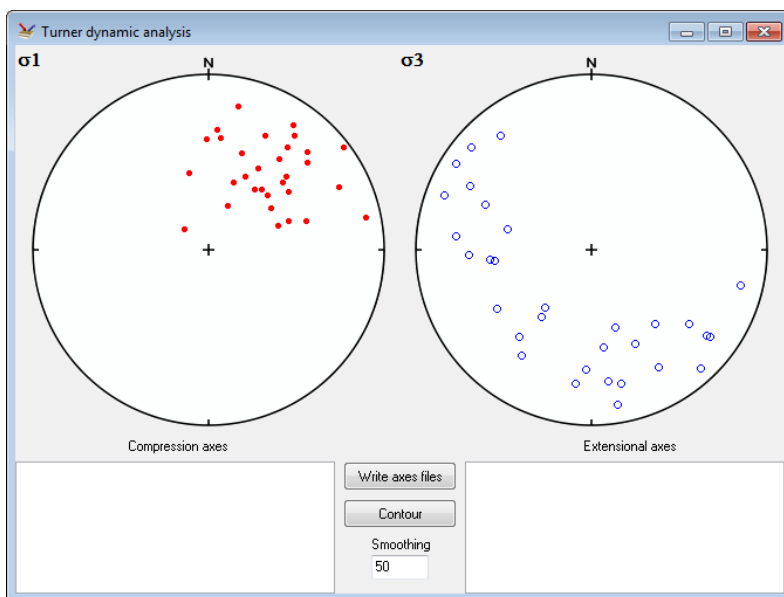
Right-dihedra method

This sub-form is displayed after clicking on button. The calculation runs immediately or after clicking the same button on the sub-form. ☐ Schmid criterion sets, whether the Schmid criterion is used as a probability function f_μ or a standard right-dihedra is performed. Maxima and minima are plotted in the right plot and written into the text window below.
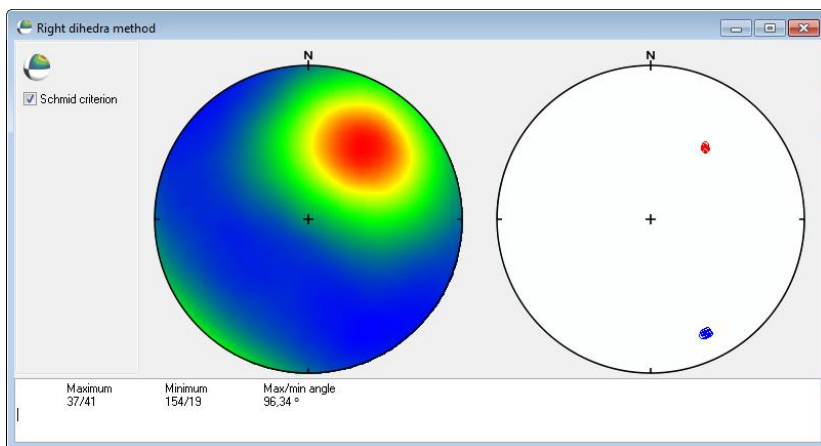

Total-search method

Total-search method is the main stress analysis tool that TwinCalc provides. It is strongly recommended to familiarize the method and terminology before proceeding, e.g. here. Even though this procedure uses up to 20 CPUs/threads it can be quite time consuming (depending on the directional increment and data file size). It is recommended to run the procedure with lower resolution (bigger directional increment) to test the performance and then to run the analysis in "production" quality.

The sub-form has three main parts: toolbar (mainly for results management), settings panel and panes with results. The analysis is run in consequent steps (phases) by buttons 1 to 5 (e.g. ⨁), however, buttons 2-5 are deactivated by default and are activated one by one by running a previous phase analysis. All buttons are deactivated during analysis to

prevent any missclick. The progress is indicated by a black progress-bar in the status bar of the main form. The analysis can be run one phase after another by appropriate buttons (to give the user an opportunity to qc and possibly influence the results) or fully automatically via 🔍 button. In this case a next phase analysis is run only if the remaining lamellae exceed the limit set in the edit box Minimum of twins required for another phase in the settings panel. To stop the analysis any time press 🛑 button (be patient, some cycles have to be finished before stopping).
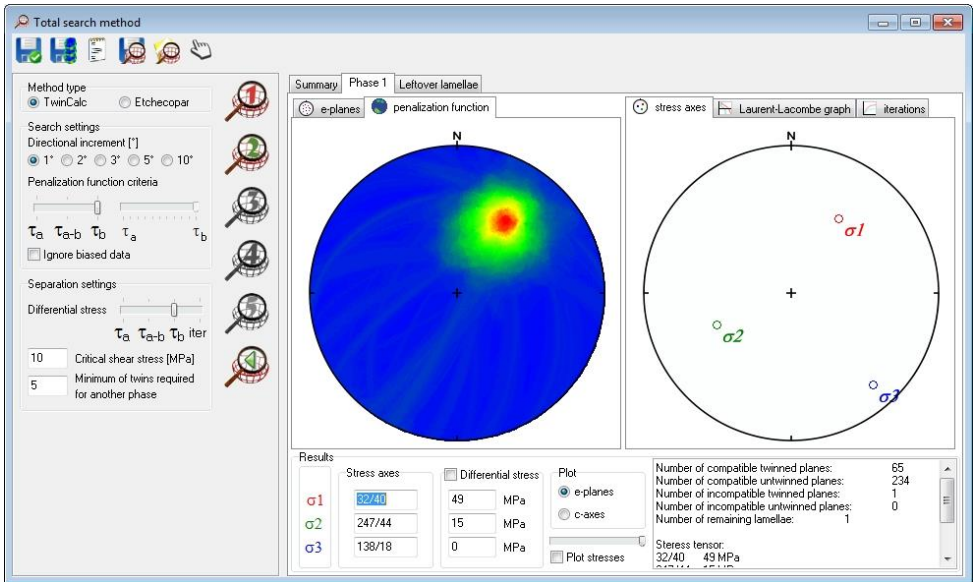

TwinClc does not include biased data into the analysis, the user can override this by checking ☐ Ignore biased data.

Most of the toolbar buttons are used to manage total-search analysis results. 💾 saves a separated homogeneous data file of active phase (it's tab is on the top of others) in TwinCalc *.twn format. 💾 button saves all penalization function distribution plots of the active phase (all 11+1 plots) as bitmaps into the last-opened folder (e.g. the folder with the main data file). The user can display the penalization function matrix (σ_1 a σ_3 orientations, penalization function for all shape parameters plus maximum/minimum for each row) in the Summary tab text window by

pressing ⬚ button. ⬚ button saves results of all phases for later use. The user can set in the dialog box whether to save just the results (stress tensors and penalization functions) or all results including graphics. TwinCalc saves a *.ttwn file and creates a folder (with the same name) with all additional files (text files with the results, bitmaps etc.). If you want to copy the results elsewhere make sure you copy the *.ttwn file and the folder, otherwise it would not work. To load previously saved result use ⬚ button. The last button on the toolbar ⬚ („manual regime") can be used for reseparation of homogeneous data file of active phase when the user decides to change parameters of the stress tensor or selecting a completely different one either using the penalisation function distribution plot (see below) or manually. Warning! All consequent phases will be deleted!

The settings panel has three sections. Method type sets, whether penalisation function f_R (◉ TwinCalc) or f_L (◉ Etchecopar) is used for the analysis. Search settings panel is used to set the directional increment in degrees (shape parameter step is always 0.1) and penalisation function criterion type on the track bar − τ_a or τ_b, or their combination (set using the right track bar when τ_{a-b} is set). When using f_L, the user can as a secondary criterion for the best-fit tensor selection use nT (by checking ☐ Parlangeau), which i the number of 6D stress tensor vectors for all directions with f_L


- nCT — nIU — nCT-nIU
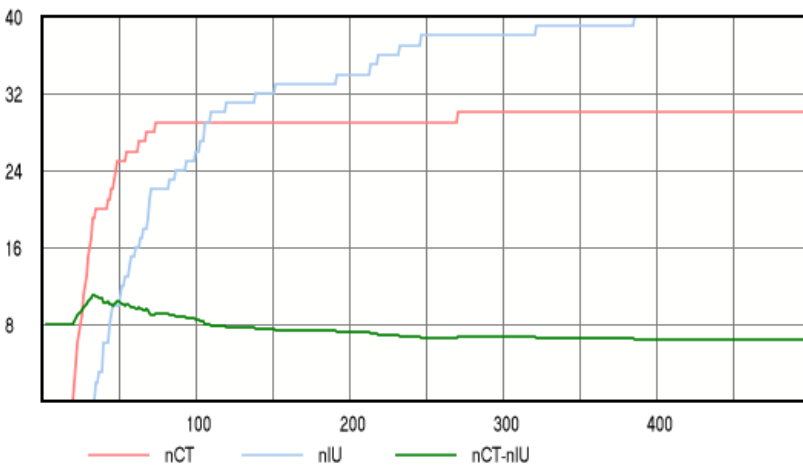
lower than fL limit within the Angle limit set in the form[4]. nT numbers can be also displayed in the penalisation function plot using ⊙ nT, or as a multiplier or diviser of f_L using the rest of radiobuttons.

Separation settings panel is used to set parameters used for differential stress calculation. Similarly to the previous panel either τ_a, τ_b, or their combination can be used (for this is used the trackbar on panel Search settings). Alternatively, an optimization procedure based on the number of compatible twinned (nCT) and incompatible untwined planes (nIU) can be used (iter on the trackbar). A qc graph of nCT and nIU versus differential stress is plotted in iterations tab in the tab of the active phase. Edit boxes oat the bottom of the panel are used to set τ_c (CRSS, 10 MPa by default) and a minimum of twins required for another phase (mainly for the automatic procedure, but implies for the manual analysis as well).

The results are presented in tabs in the right side of the sub-form (phase 1 in Phase 1 tab etc.). Normal stresses are written into edit boxes in the bottom left part of the tab, all parameters of the phase into a text window in the bottom right part (number of compatible and incompatible e-planes, normal stresses of the stress tensor, τ_a a τ_b, and the reduced stress tensor as a 3x3 matrix).

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[4] Parlangeau, C., Lacombe, O., Schueller, S., Daniel, J.M., 2018. Inversion of calcite twin data for paleostress orientations and magnitudes: A new technique tested and calibrated on numerically-generated and natural data. Tectonophysics 722, 462-485.
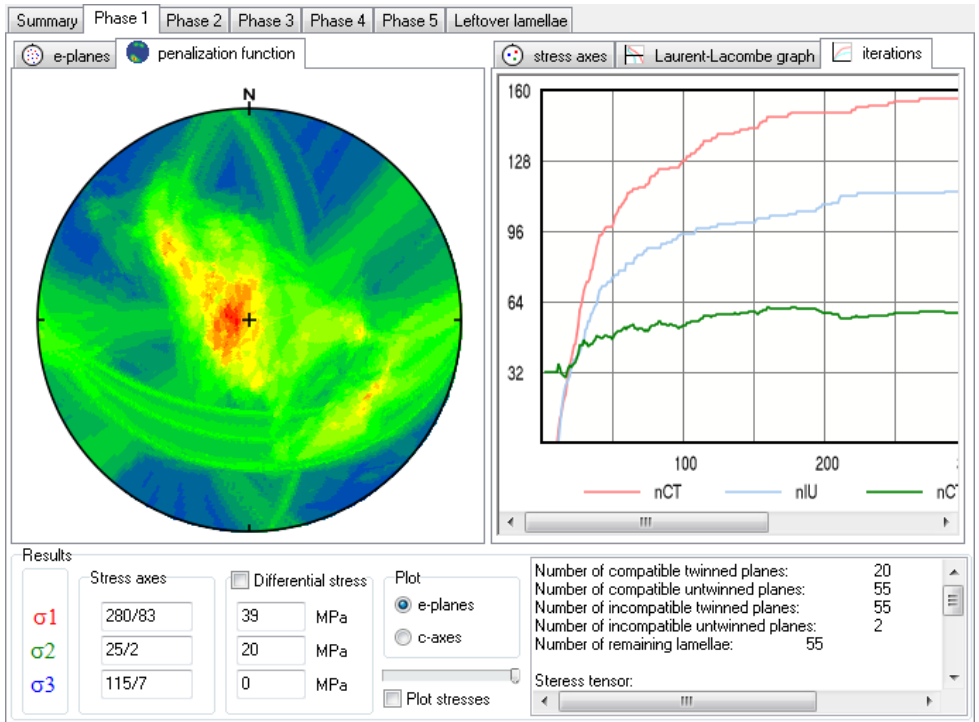
Every stress phase tab contains two sets of tabs with plots and graphs. The left group of tabs comprises two tabs: e-planes and penalisation function. e-planes tab contains an *e*-plane poles plot of the separated homogeneous data set, compatible twinned planes are in red, compatible untwined planes in blue and incompatible untwined planes in violet. Penalisation function tab contains the penalisation function distribution plot. This plot shows maximal (minimal for f_L) magnitude of the penalisation function of all stress tensors with the same σ_1 orientation. Penalisation function magnitude is color-coded: maxima (minima for f_L) in red, minima (maxima for f_L) in blue. Magnitudes of the penalisation function are shown if you hover with the mouse cursor above the diagram. The penalisation function can be visualized either as one diagram representing maxima (minima for f_L) for all shape parameters or as a sequence of 11 diagrams, each one for one particular shape parameter Φ. Φ can be set by the track bar in the bottom part of the tab (0 to the left, 1 to the right; the right-most position plots the

diagram for all shape parameters). Shape parameter is written in the top right corner of the penalisation function distribution diagram.

Right group of tabs contains stress axes tab, with a normal stresses plot, Laurent-Lacombe tab with the Laurent-Lacombe graph and finally iterations tab, with the iterations graph.

As mentioned above, 👆 button can be used to reseparate the homogeneous data set of active phase (warning! all subsequent phases will be deleted!) should the user decide to change some parameters. The easiest case is changing the differential stress calculation parameter using the Differential stress track bar on Separation settings panel. The user can cross-check the resulting changes using the Laurent-Lacombe graph, the iteration graph and the text window with all parameters of the phase in the bottom right part of the active phase tab. The user can also change the stress tensor completely using the penalisation function distribution plot. If the ☐ Plot stresses checkbox is checked and the user hovers with the mouse cursor above the penalisation function distribution plot, TwinCalc plots normal stresses of that particular stress tensor in the stress axes plot. When the left mouse button is clicked, a "draft" separation is run and numbers of compatible and incompatible planes and normal stresses are written into the text window and edit boxes in the bottom part of the tab. To accept the new stress tensor, click 👆 button, otherwise uncheck the ☐ Plot stresses checkbox. Stress tensor axes can be entered completely manually via edit boxes in the Stress axes panel (the axes have to be orthogonalised, TwinCalc does not check their orthogonality!). Magnitudes of differential stresses or the stress tensor shape parameter can be changed manually after unchecking ☐ Differential stress checkbox. σ_2 magnitude has to be calculated manually using $\Phi = \sigma_2 - \sigma_3 / \sigma_1 - \sigma_3$ formula. If the ☐ Differential stress is checked, differential stresses are calculated automatically according to Differential stress track bar settings.

Jamison and Spang method

The sub-form contains the Jamison and Spang graph and a table with results – twinning incidence and differential stress for each grain class. Note: Polyphase data sets have usually high twinning incidences for one and two twin system classes, exceed the graph boundaries and yield unrealistic results (see example ↓).
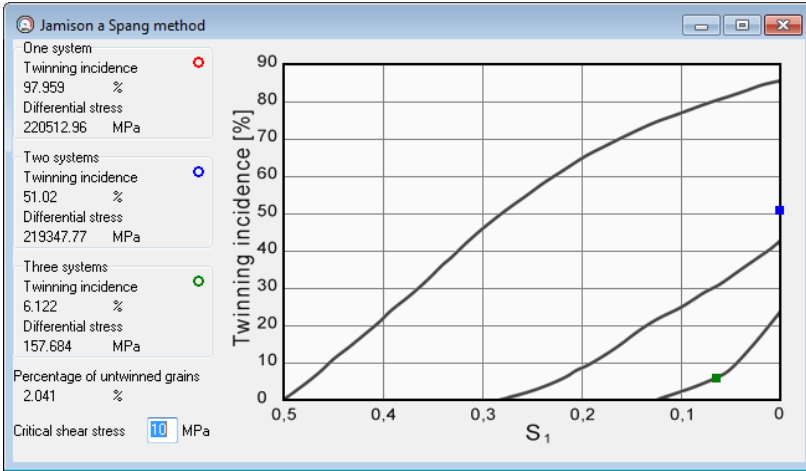
Rowe and Rutter method

This sub-form has four tabs: the first one with the data and another three with Rowe and Rutter plots. 📊 button can be used to plot the grain size histogram, 📋 copies the table into clip-board.

Ferrill et al. method

This sub-form contains only the graph and its settings: graph color scheme, point size (track-bar) and point color (can be set by left-clicking on the color rectangle next to the point size track-bar.
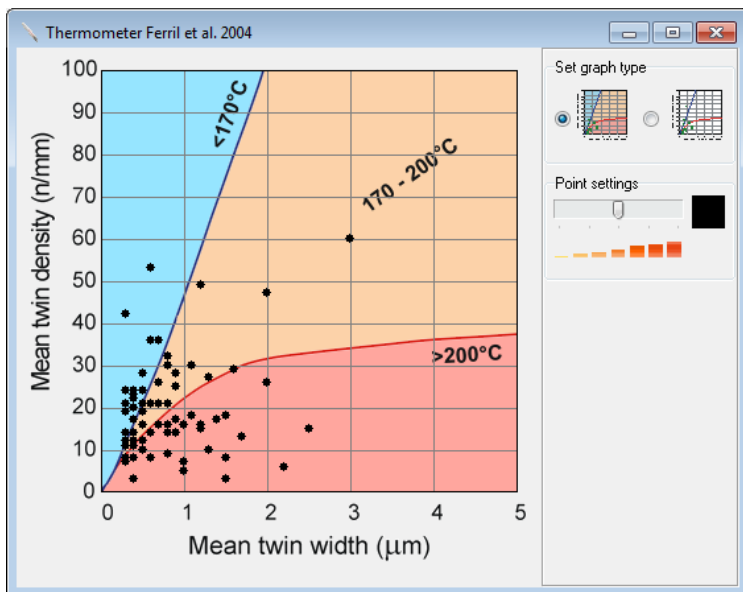
Settings

TwinCalc creates an ini file after the first use (in the same folder as TwinCalc.exe) which stores all settings. TwinCalc has currently two language options – english and czech.

The user can set the size of emf plots. By default it is ca. 3 x 3 m, because TwinCalc uses Windows GDI library which can create only integer coordinates metafiles. The plots have to be that big to be circular. It is possible to set the plots smaller, but especially small circles would no longer be circular. It is therefore better to export the plots in the default size and resize them in some graphic editor.

Some procedures of TwinCalc are multithreaded. TwinCalc uses by default maximal number of threads (up to 20). This number can be reduced by checking ⊙ user input and selecting the number of threads in the spin edit next to the radiobutton in the Set number of CPUs panel[5].

☐ BW plots can be checked if the user wants density distribution plots to be in grayscale (for BW papers etc.)

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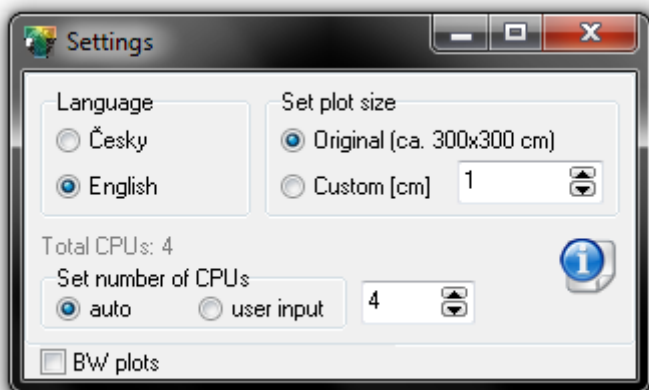
[5] This is necessary is a "Stack overflow" message pops up during a total search procedure, your machine has not enough RAM for all the threads.

Epilogue

TwinCalc is a Windows application for stress analysis based on calcite twinning using most of available methods as well as new ones. Despite all effort to debug the application entirely, you may encounter a bug now and then. I apologise for that and ask you for a bug "report" (jura@eltekto.cz).

Hail to structural analysis :-)

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