# Version 2018

PANUKL

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# PANUKL – user manual

The current document presents the description of graphic user interface of the **PANUKL 2018** package and all available options. The external programs are described in the separated files. To run **PANUKL's GUI**, click **GridView** managing subprogram icon on the desktop or in the START MENU. After few seconds the main application window displays (Fig. 1) and **PANUKL** is ready to operate.



Fig. 1 - Main application window

To change program window size use standard WINDOWS buttons. User can access the particular program functions from drop down managing application MENU..

## **FILE menu description**



Fig. 2 - Menu – FILE

#### Available options in FILE menu

Function	Description
Open grid file [Ctrl+O]	Open grid file [.inp], from user selected disc location Fig. 3.
Open grid file with Wake [Alt+Ctrl+O]	Open [.dat] file from user selected disc location containing grid and wake
Open pressure distribution file [Alt+Ctrl+T]	Open [.txt] file from user selected disc location containing pressure distribution and other results (velocity components, Mach number, etc.).
Open and show results file	Show results file [.out] or [.czy]) , Fig. 5.
Save picture as [Ctrl+S]	Save the current window picture to <b>JPEG</b> , <b>PNG</b> or <b>BMP</b> format file. The dialog window will appear Fig. 4
Evit	
[Alt+X]	End program, exit application.

The names of last opened files (20 in each of the four groups "Open") are saved and user can select them from drop down menu (Fig. 2).

Fig. 3 – File selection window (example)

File selection Windows can be different dependent on the current operating software version, window looks does not influence PANUKL's functionality.

💹 Select/Enter bitmap file name:				×
← → × ↑ 📙 > tgrab > PanuklProjects > xfoil	~ Ö	Search xfoil		Q
Organize 🔻 New folder				?
ConeDrive Name	Date modified	Туре	Size	
This PC	06.12.2017 12:25	File folder		
3D Objects				
Cesktop				
Documents				
🖶 Downloads				
J Music				
Pictures v <				>
File name: test.jpg ← file name				~
Save as type: JPEG (*.JPG) (*.jpg) $\leftarrow$ file extended	ension			~
∧ Hide Folders		Save	Cancel	
pictur	re format a	valiable onl	y in <b>WII</b>	NDC

Fig. 4 – Save to graphic file current PANUKL window (only workspace)

📐 Output — 🗆 🗙	🔀 Open File	
File Edit	← → × ↑ 🔤 « sample » predator » out 🗸 ⊘ Search out	ρ
Data from file:	Organize 🔻 New folder 📰 💌 🛄	0
C:\Users\tgrab\PanuklProjects\sample\predator\Predator_5.pan	This PC Name Date modified Type	
	20 Objecht         Predeter_Sout         20.132071665         OUT File           Dextop         Predeter_mo_wingout         13.1220171623         OUT File           Documents         Mark         Predeter_mo_wingout         13.1220171623         OUT File           Documents         Predeter_mo_wingout         13.1220171623         OUT File           Mark         Predeter_mo_wingout         13.1220171623         OUT File           Wolters         V	
Angle of attack, sideslip angle and Mach number: Alfa = 5.00000 Rates = 0.00000	File game Predator_Sout	~
Mach = 0.00000	* • • • •	
angular velocities: P = 0.00000 Q = 0.00000 R = 0.00000	ev	
Global results :		
in body axis system: Cx =502512r-01 Cy =964202r-04 Cz = 0.745102 Cl = 0.4974332r-05 Cm =313268 Cn =7313682r-04		
in stability axis system: cx = 0.14601E-01 cy =98120E-04 cz = 0.746670 cl =14189E-05 cm =318238 cn =732920E-04		
Induced drag and corresponding lift coefficient: Cxi= 0.814765E-02 Czi= 0.712451		

Fig. 5 – Output results window example

# VIEW menu description

🗼 P	anukl 20	18 - Grid	l viewer					-	×
File	View	Data	Create	Xfoil	Tools	Help			
	Redrav	v (1:1)		F5					1
	Fit to w	indow		F2					
	Orthog	onal vie	w	Þ	Left	Ctrl+1			
	Custor	n view		F6	Right	Ctrl+2			
	Origin .				Up	Ctrl+3			
	Enlarg	е		+	Down	Ctrl+4			
	Reduc	е		-	Front	Ctrl+5			
	🔽 Turr	n on key	board cor	ntrol	Rear	Ctrl+6			
Statu	s: no dat	а							

Fig. 6 – Menu – VIEW

#### Available options in VIEW menu

Function	Description
Redraw (1:1)	Redraw current object in main application window, restore the
[F5]	original scale of the object.
Fit to window F2	Fit to the window size
<b>Orthogonal view</b>	Orthogonal view selection: Left – Ctrl-1 Right – Ctrl-2 From up – Ctrl-3 From bottom – Ctrl-4 Front – Ctrl-5 Rear – Ctrl-6
Custom view F6	Saved view
Origin	Show the window to set the origin of rotation (Fig. 7)
Enlarge [+]	Zoom (+)
Reduce [-]	Zoom (-).
Turn on keyboard control [check box]	Turn on keyboard control for analyzed object, Fig. 8



Fig. 7 – Window to set the origin of rotation



Fig. 8 – Keyboard controls explanation

## **DATA menu description**

📐 Panukl 20	18 - Grid viewer	-	×
File View	Data Create Xfoil Tools Help		
	MS2 editor Fuselage program Fuselage program Fuselage python script Python command Propellers configuration Profiles library Select Profile Library Create NACA profile Copy Samples C Xfoil directory		
Status: no da	a		_

Fig. 9 – Menu - DATA

Various tools for editing and data management are available in the **DATA** menu. The following options mean:

- MS2 Editor invoking the MS2edit program for editing MS2 script files [1]
- Fuselage program invoking the Fuselage program utilized to create a file with the geometry of the fuselage created earlier in the program NX [2]
- Fuselage python script invoking the Python script utilized to create a file with the geometry of the fuselage created earlier in the program NX [2]
- Python command Python interpreter command options
- Propellers configuration invoking the ActuatorDisc program for editing the propellers data file ([.acd]).

				_							
📐 Outpu	ıt		- 🗆	$\times$	🗼 Pro	file graph					⊐ ×
File Ed	it										
26	ŧ	NACA 64	2 215		Z						
o.	0.	0.	0.								
0.399	1.254	0.601	-1.154				1				
0.637	1.522	0.863	-1.382		404						
1.122	1.945	1.378	-1.731		1		1	1	1	1	
2.353	2.710	2.647	-2.338		1		1		1	1	
4.836	3.816	5.164	-3.184		1						
7.331	4.661	7.669	-3.813		20						
9.831	5.356	10.169	-4.322		20				1		
14.840	6.456	15.160	-5.110				1	1	1	1	
19.857	7.274	20.143	-5.682							1	
24.878	7.879	25.122	-6.089								
29.901	8.290	30.099	-6.346		10-{-						
34.926	8.512	35.074	-6.452								
39.952	8.544	40.048	-6.402		1						
14.977	8.319	45.023	-6.129						i i	i i	
50.000	7.913	50.000	-5.707				1			1	
55.020	7.361	54.980	-5.171		-20						
50.036	6.691	59.964	-4.549		1				1	1	
65.048	5.925	64.952	-3.865								
70.055	5.085	69.945	-3.141								
75.058	4.191	74.942	-2.401		-40						
30.055	3.267	79.945	-1.675								
35.046	2.349	84.954	-1.003						1		
90.033	1.466	89.967	-0.432			,					
95.016	0.662	94.984	-0.030		1		20	40	60	80	10
100.00	0.	100.00	0.		ľ		20	-10		00	
								nacae	42215		
					1						

Fig. 10 - Browsing the profile library

- Profiles library browsing the profile library (Fig. 10)
- Select Profiles library the user has one of three options to choose from:
  - o Panukl Library library embedded in the PANUKL package
  - User Library user profile library
  - Xfoil Library library of profiles created/modified by the program Xfoil [3]
- Create NACA profile create a file with profile geometry from a four or five-digit family of classic profiles NACA
- Copy Samples copying files with examples provided with the package to the working directory. When copying, the configuration files are modified to adapt the data to the user's directory layout.

# **CREATE** menu description



Fig. 11 – Menu – CREATE

In the CREATE menu, the user will find the most important functions of the PANUKL package that enable a complete calculation session to be performed for a given input data set.

### Create grid file (F9)

The command calls the **Mesh3** program, component of the **PANUKL** package, which for a selected data set containing the description of the object (aircraft) geometry (file [.ms2]) will generate a file containing the [.inp] grid defining the object's geometry. The grid consists of quadrangular panels, Fig. 12.



Fig. 12 – Creating grid file for current input geometry data

#### Create grid file with the neighbours (F10)

1

The command calls the Neigh program, component of the PANUKL package, which for the selected file containing the [.inp] grid of the model, will generate a [.dat] file. The output file [.dat] stores the model's grid with the generated vortex wake and information about the numbers of "neighbors" of individual grid panels

After selecting this option, the user has two options:

Option No. 1 – we do have saved on disk configuration file [.ngh], Fig. 13

Run **Create grid file with the neighbours** and select saved configuration file **[.ngh]** – file contains all necessary information to create **[.dat]** file. To open selected **[.ngh]** file click **OPEN** button. Configuration window will appear (Fig. 13) where one can see saved **[.dat]** file creation options. To generate **[.dat]** file click **Save and Compute (OK)** button.

Option No. 2 - we do not have saved on disk configuration file [.ngh], Fig. 13

Run **Create grid file with the neighbours** and click **CANCEL** button when prompted for saved configuration file **[.ngh]**. The configuration window will appear (Fig. 13) where user can select options to create **[.dat]** file. To save current **[.dat]** options to **[.ngh]** file click **Save [.ngh] file as**, to create **[.dat]** file click **Save and Compute (OK)** button.

Select [.ngh] file:	×	💹 Select [.ngh] file:			×
🕥 🎉 🔹 Łukasz	Stefanek • Panukl • dat • neigh 🔹 🕼 🤟	🚫 🖟 🕹 tukasz Si	tefanek 🕶 Panuki 👻 dat 👻 neigh	👻 🔛 Wyszukaj	2
Organizuj 🔻 🏥 Wide	oki 🔻 📑 Nowy folder 🛛 🔞	👆 Organizuj 👻 🏥 Widok	i 🔻 📑 Nowy folder		0
Ilubione łącza	Nazwa * + Data modyfikacji + Typ + Rozmiar +	Ulubione łącza	Nazwa 🔺 🔸 Data modyfikacji 🖡	- Typ  - Rozmiar  -	
Dokumenty	Predator.ngh	Dokumenty			
Pulpit	we do have	Pulpit	we	don't have	
Obrazy	configuration * ngh file	Dbrazy	configu	ration * ngh f	ile
Muzyka	ooningaration ingir no	💽 Muzyka	ooninge	ination inght	
Ostatnio zmienione		Ostatnio zmienione			
/ Wyszukiwania Publiczny		Wyszukiwania Publiczov			
( doncerty		. Concerty			
olden		Folden			
oldery .		Toldely			
Nazwa	piku: Predator.ngh	Nazwa pi			
			CAN		Anulu
	click to check saved options	•	click to select *.d	at file creation	options
	nch] file parameters				
5	angrij nie parameters				
	Input grid file [ inp] C:/Users/Lucas/Papukl/dat/inp/Predator	rinn		Browse	
	nipal gria no [nip] es considerada i analisada nipi rodalar	ik			
	Output grid file [.dat] C:/Users/Lucas/Panukl/dat/dat/Predator	.dat		Browse	
			12		
	30.0 Trailing edge angle [deg]:	Wake type des	cription:		
	60.0 Neighbour condition angle [deg]:	0 - wake paralel to	MAC wash due to apple of att	ack.	
	50 Apple of attack (deg)	2 - wake with down	wash due to sideslip an	gle	
	Angle of attack [deg].	3 - wake paralel to	the freestream		
	O Sideslip angle [deg]:	4-6 - wake with the	same effect as in cases	:1-3	
		but only for fas	t wake pariers		
	20.0 Lenght of the wake (last panel - MAC multiplicati	ion)			
	A Woko hmo				
	V WAKE type				
-	1	-			
	Save and Compute (O.K.) Save	[.ngh] file as	Cancel	B	

Fig. 13 – The dialog window to run Neigh program

Setting	Description
Length of the wake (MAC multiplication)	Length of the wake (MAC multiplication)
	Wake type creation methods:
	0 – Wake parallel to MAC
	<ol> <li>Wake with downwash due to angle of attack</li> </ol>
Wake type description	2 – Wake with downwash due to sideslip of attack
	<ul> <li>3 – Wake parallel to the free stream</li> </ul>
	4, 5, 6 – Wake with the same effect as in cases 1-3
	but only for last wake panels
	Trailing edge angle. If the angle between two trailing edge grid
Trailing edge angle [deg]	panels is lower or equal to defined value, than wake line will
	be created from such trailing edge.
Neighbour condition	Neighbor condition angle. If the angle between two
angle [deg]	neighboring grid panels is higher than defined value, both
0 1 01	panels are not treated as neighbours.
Angle of attack [deg]	Angle of attack (taken into account during wake creation).
Sideslip angle [deg]	Sideslip angle (taken into account during wake creation).



Fig. 14 – Example file: grid & wake "Predator.dat"

#### **Compute doublet distribution (F11)**

The command starts the program Panukl, component of the PANUKL package, which will generate the file [.pan] for the selected data file [.dat]. In the output file [.pan] the resultant distribution of the velocity potential is saved. The file is saved as so-called free format - read and write only by package programs.

After selecting this option, the user has two options:

#### Option No. 1 – we do have saved on disk configuration file [.par], Fig. 15

Run **Compute doublet distribution** and select saved configuration file **[.par]** – file contains all necessary information to create **[.pan]** file. To open selected **[.par]** file click **OPEN** button. Configuration window will appear (Fig. 15) where one can see saved **[.pan]** file creation options. To generate **[.pan]** file click **Save and Compute (OK)** button.

#### Option No. 2 – we do not have saved on disk configuration file [.par], Fig. 15

Run **Compute doublet distribution** and click **CANCEL** button when prompted for saved configuration file **[.par]**. The configuration window will appear (Fig. 15) where user can select options to create **[.pan]** file. To save current **[.pan]** options to **[.par]** file click **Save [.par] file as**, to create **[.pan]** file click **Save and Compute (OK)** button.

Select [.par] file:	×	Select [.par] file:	A REAL PROPERTY AND A REAL		×
🔘 🖟 • Łukasz S	tefanek • Panuki • dat • panuki 🔹 😰 😡	🕥 🌗 • Łukasz S	tefanek • Panuki • dat • panuki 🔹 🙆	Wyszukaj	- 2
🕙 Organizuj 👻 🏭 Widok	d 👻 📑 Nowy folder 🕢 🔞	🕘 Organizuj 👻 🏭 Widol	d 🔻 📑 Nowy folder		0
Ulubione łącza	Nazwa Data wykonania - Tagi - Rozmiar - Klasyfikacja -	- Ulubione łącza	Nazwa 🔶 🕶 Data wykonania 💌 Tagi	Rozmiar     Klasyfikacja	+
Dokumenky  Vujak  Vujak  Muzyka  Muzyka  Wyszuláwania  Publiczny	we do have *.par file	Dokumenty Lipit Fulpit Komputer Cohrasy Muzyka Gotatnio zmienione Wyszakwania Publiczny	<u>we do not ha</u>	i <u>ve</u> *.par file	
Foldery 🔨		Foldery ^			
Nazwa p	iku: Predator.par V ♥	Nazwa p	CANCEL	T.par Files     Otwórz     Anult	• •
cl	lick to check saved options	L.	click to select *.pan file	creation option	IS
📐 C:\Users\	tgrab\PanuklProjects\sample\predator\Predator_5s0_acd.par			– o x	
Inp	ut grid file [.dat] C:\Users\tgrab\PanuklProjects\sample\preda	ator\Predator_s0.dat		Browse	
c	output file [.pan] C:\Users\tgrab\PanuklProjects\sample\preda	ator\Predator_5s0.pan		Browse	
Propellers	s data file [.acd] C:\Users\tgrab\PanuklProjects\sample\preda	ator\ADconfig_test1.acd		Browse	
Angle Sides	e of attack [deg]: 5 Roll rate [rad/s]: 0 slip angle [deg]: 0 Pitch rate [rad/s]: 0 Mach Number: 0 Yaw rate [rad/s]: 0	→ LA	Linear equation solver: PACK optimized procedure coptimized procedure pellers data active		
Sa	ve and Compute (O.K.) Save	[.par] file as	Can	cel	

Fig. 15 – Dialog window to set parameters and to run Panukl program

Parameter/setting	Description				
	Linear equation solver selection:				
Linear equation solver	- LAPACK optimized procedure (default)				
Linear equation solver	- not optimized procedure (more time consuming procedure				
	but more accurate)				
Angle of attack	Angle of attack [deg], measured from free stream velocity direction				
Aligie of attack	and <b>OX</b> axis.				
Sideslip angle	Sideslip angle [deg].				
Mach Number	Mach number				
Roll rate	P – roll rate [rad/s]				
Pitch rate	<b>Q</b> – pitch rate [rad/s]				
Yaw rate	R – yaw rate [rad/s]				
Propellers data active	Activates the influence of the propellers system, defined in [.acd] file				

The Panukl program calculates the influence coefficients and solves the system of equations resulting in the distribution of the velocity potential. This module has the highest hardware requirements. The time of calculations can be significant and depends approximately on the third power of the number of panels. After completing the calculations, the Panukl program displays the message (Fig. 16).

1	Panukl computation has finished successfully !!!
	Close <

Fig. 16 – Message that computation is completed

#### **Compute pressure distribution (F12)**

The command runs the Press program, component of the PANUKL package, which for the selected data file [.pan], will generate final result files. The output file [.out] stores the results of the calculation of the total aerodynamic coefficients. The output file [.txt] stores the results of calculations related to the speed components, singularities, pressures etc. for individual panels. In the output file [.eps], the results of downwash calculation (set created optionally) are saved.

Option No. 1 – we do have saved on disk configuration file [.prs], Fig. 17

Run **Compute pressure distribution** and select saved configuration file **[.prs]** – file contains all necessary information to create output result files – **\*.out**, **\*.txt**, **\*.eps**. To open selected **[.prs]** file click **OPEN** button. Configuration window will appear (Fig. 17) where one can see saved **[.prs]** file creation options. To generate **output** files click **Save and Compute (OK)** button.

Option No. 2 - we do not have saved on disk configuration file [.prs], Fig. 17

Run **Compute pressure distribution** and click **CANCEL** button when prompted for saved configuration file **[.prs]**. The configuration window will appear (Fig. 17) where user can select options to create **output** files – **\*.out**, **\*.txt**, **\*.eps**. To save current **output** files options to **[.prs]** file click **Save [.prs] file as**, to create **output** files click **Save and Compute (OK)** button.

Select [.prs] file:		×	Select [.prs] file:			×
🕖 😺 • Łukasz Sł	refanek • Panuki • dat • press 🔹 🖬 🗤 🗤 🗤		🔨 📔 🔹 Łukasz St	efanek • Panukl • dat • press 🛛 • 🛂	Wyszukaj	2
👌 Organizuj 👻 🧱 Widok	i 🔻 📴 Nowy folder	0	Organizuj 👻 🏭 Widoki	<ul> <li>Nowy folder</li> </ul>		
Ulubione łącza	Nazwa + V Data modyfikacji + Typ + Rozmiar +	U	ubione łącza	Nazwa 🔺 🔹 Data modyfikacji 🔹 Typ	Rozmiar +	
Dokumenty	-Prienator		Dokumenty			
Pulpit			Pulpit			
Obrazy		10	Obrazy			
Muzyka		P	Muzyka			
Ostatnio zmienione	we do have *.prs	B	Ostatnio zmienione	we do not l	nave *.prs	5
Wyszukiwania	configuration file		Wyszukiwania	configura	ation file	
J Publiczny		*	Publiczny			
Foldery			oldery			
Nazwa pl	ikuz Predator	<u> </u>	Nazwa pli		".prs Files	
		Anuluj		CANCEL	Otwórz	Anuluj
click to	o check saved options		<b>•</b>	lick to select *.prs file	creation o	ptions
Press [.prs]	file parameters				- 🗆	×
Input file [.	pan] [C:\Users\tgrab\PanukIProjects\Predator\	Predatorpan		Browse	Output files na	ames
						-
Range of	r panel's indices used for pressure calculation	10000	calcu	ation method (0-8 see user mai	nual)  4	
X co	ordinate's range used for pressure calculation	0 100	ave	aging of the local coordinate sys	stem ⊻	
✓ X comp	onent of pressure taken into account for pitchir	ng moment calculation		Automatic output files na	imes 🗹	
Downwash o	calculation:	Number of mesh po	ints for downwash	calculation longwise Y (X) axis:	25	
None		Number of mesh	points for downwa	sh calculation longwise Z axis:	8	
♦ YZ plane		)	(Y) coordinate of p	lane for downwash calculation:	7	
(XZ) plan	e		Y (X) boundary co	ordiantes of downwash mesh:	-15 15	_
ul drag in th			7 houndary or	ardiantes of downwash mash:		_
✓ drag in u	ie frenz plane		2 boundary co	ordiantes of downwash mesh.	-9  9	
Compre	essible correction: 🚸 None 🔷	Prandtl-Glauert	♦ Karman-Tsie	Mach Number:	0	
0.00	a and Compute (O.K.)	Cours I pro 1 file		0.00		1
- Sav	e and compute (C.K.)	Save [.prs] life	do			

Fig. 17 – Dialog window to run program Press

📐 Output Files Names	-						
General output file [.out]	C:\Users\tgrab\PanuklProjects\sample\wings\out\Predator_5.out	Browse					
Spanwise distribution [.czy]	C:/UsersitgrablPanuklProjects\sample\wings\outlPredator_5.czy	Browse					
Pressure distribution [.txt]	C:\Users\tgrab\Panuk Projects\sample\wings\out\Predator_5.bt	Browse					
Downwash field [.eps]	C:\Users\tgrab\Panuk Projects\sample\wings\out\Predator_5.eps	Browse					
Countur of cross section [.bln]	C:\Users\tgrab\Panuk Projects\sample\wings\out\Predator_5.bln	Browse					
SDSA compatible file [.sdsa]	SDSA compatible file [.sdsa] C:\Users\tgrab\PanukiProjects\sample\wings\out\Predator_5.sdsa						
	OK Correl						
	Cancel						

Fig. 18 – Dialog window to define output files names

Setting/Function	Description
Range of panel's indices used for	The values are the numbers of the first and the last panel which will
pressure calculation	be taken into account to compute global aerodynamic coefficients.
X coordinate's range used for	The starting and ending value of the X coordinate of the interval that
pressure calculation	will be taken into account to compute the global aerodynamic
	coefficients.
X component of pressure taken	Selecting the checkbox will take into account the X-component of
into account for pitching moment	the pressure when calculating the global values of the pitching
calculation	moment.
	Selection of the method of differentiation of potential distribution
	(There are four basic methods and their average ones. The basic
Calculation method (0-8)	methods are based on the determination of a polynomial
	based on known potential values on a given panel
	and his 8 heighbours):
	<ul> <li>average from two out four of described below methods,</li> <li>collocation method , with polynomial;</li> </ul>
	$\mathbf{I} = \frac{1}{2} \left[ -\frac{1}{2} \left$
	$\psi(x,y) = Ax$ $y + bx$
	- with nolynomial:
	$\omega(x,y)=Bx^2y+Cxy^2+Dxy+Ex^2+Fy^2+Gx+Hy+I.$
	3 - approximation with polynomial:
	$\varphi(x,y)=Bx^2y+Cxy^2+Dxy+Ex^2+Fy^2+Gx+Hy+I,$
	<b>4</b> – (default) approximation with polynomial:
	φ(x,y)=Dxy+Ex <sup>2</sup> +Fy <sup>2</sup> +Gx+Hy+I,
	<b>5</b> – method 1, 2 i 3,
	<b>6</b> – method 1, 2 i 4,
	<b>7</b> – method 1, 3 i 4,
	<b>8</b> – method 2, 3 i 4.
Averaging of local	Elimination of possible errors during the potential differentiation
coordinate system	resulting from the unfavourable "numerically" position associated
coordinate system	with the local panel coordinate system .
	Downwash (angle of deviation) computations:
Downwash calculation:	None – downwash is not computed
	(result <b>[.eps]</b> file is not created),
	YZ plane – downwash results are computed in OYZ plane,
Number of most volute for	XZ plane – downwash results are computed in OXZ plane
Number of mesh points for	The number of points along the <b>Y</b> (or <b>X</b> – if <b>XZ plane</b> ) axis in which
downwash calculation longwise f	the downwash angle will be calculated.
(A) axis.	
downwash calculation longwise 7	The number of points along the <b>Z</b> axis in which the downwash angle
axis:	will be calculated.
X (Y) coordinate of plane for	The value of the X coordinate (or Y - if XZ plane) of the plane. in
downwash calculation:	which the downwash angle will be calculated
	The initial and final value of the Y coordinate (or X - if XZ plane),
Y (X) boundary coordinates of	limiting the rectangular area in which the downwash angle will be
downwash mesh:	calculated.
Z boundary coordinates of	The initial and final value of the <b>Z</b> coordinate, limiting the
downwash mesh:	rectangular area in which the downwash angle will be calculated.

Drag In the Trefz plane	Computing the induced drag in the <b>Trefz</b> plane.					
	Compressibility correction method for set Mach number:					
Compressible correction:	None – no correction,					
	Prandtl-Glauert – correction method					
	Karmana-Tsien – correction method.					
Automatic output filonamos	Automatic result file names - result files have the same base name as					
Automatic output menames	[.pan] file and only extensions are changed					
Output files names	Displays a dialog window to define the individual output file names					
Output mes names	– Fig. 18					

#### **Compute sequence (Shift-F10)**

The command starts the PanAuto program configuration window (Fig. 19), which is used to automate the basic calculation of the package. The program allows to run one sequence of calculations, i.e. to call successively the following programs: Mesh3, Neigh, Panukl and Press with the selected configuration files. The user can observe the status of the calculation. The color of the round widget (Status) indicates the operating status: no color - the process has not yet been started, red - during the calculation, green - completed calculation.

Program can also run in the batch mode, using the following command:

```
PanAuto [filename.auto] [iGUI]
```

where:

filename.auto – configuration file (see [6]) iGUI – GUI flag (0 –off, 1 - on) (Fig. 19)

The program without parameters is always run with the graphical interface (Fig. 19). Entering only the first parameter starts the program without graphical interface.

Status		[*.ms2]	C:\Users\tarab\Panuk Projects\sample\wings\wing.ms2	1	Browse		
۲		[*.ngh]	C:\Users\tgrab\PanukIProjects\sample\wings\wing1.ngh		Browse		
۲	~	[*.par] C:\Users\tgrab\PanukiProjects\sample\wings\wing1.par					
	•	[*.prs]	C:\Users\tgrab\PanuklProjects\sample\wings\wing1.prs	1	Browse		

Fig. 19 – Dialog window of PanAuto program

#### **Prepare data for SDSA**

The command runs the **PanProject** configuration window (Fig. 20), which is used to calculate complete aerodynamic data, including aerodynamic derivatives, in a form compatible with the SDSA package [7]. The set of data (parameters) of the **PanProject** program is set using the dialog window widgets and can be saved in a file type [.prj]. The meaning of individual variables is presented in a separate document [6]. The user must prepare the file in advance with the object's grid and the

vortex wake [.dat]. To compute control derivatives, it is necessary to prepare a grid version with deflected control surfaces (elevator, ailerons, rudder). Because the process of calculating the data set to the SDSA can be time-consuming, the user can set that the calculations take place in parallel, using the multicore/multiprocessor architecture of the computer. It is recommended that the number of parallel processes be smaller than the number of cores/processors installed in the computer.

📐 Panukl Project - YA.prj				o x
File Project Create Help				
Simply project properties Parameters to prepare S	DSA data set Run projec	t for SDSA data		
SDSA project directory: C:\Users\tgrab\P	anukiProjects\YUKI\sdsa\		Brows	ie
Clean configuration (.dat) file: C:\Users\tgrab\P;	anukiProjects\YUKI\YA.dat		Brows	e
Eleveator deflection [.dat] file:			Brows	e 🔽
Aileron deflection [.dat] file:			Brows	<b>Г</b>
Rudder deflection [.dat] file:			Brows	e Г
Angle of attack sequence: START: -5 Mach number sequence: START: 0.10	END: 15 END: 0.60	STEP: 2.5 STEP: 0.40	Linear equation solver:	
Sideslip angle [deg]: 5	Estimated max. A	oA [deg]: 15	$\diamondsuit$ not optimized procedure	
Roll rate [rad/s]: 0.02	Elevator deflect	ion [deg]: 10	number of prallel process (max.): 4	
Pitch rate [rad/s]: 0.02	Aileron deflect	tion [deg]: 10	Current number of CPUs (cores): 8	-
Yaw rate [rad/s]: 0.02	Rudder deflect	tion [deg]: 10		
Range of panel's indices used for pressure	e calculation: 0 1	00000	calculation method (0-8 see user manual) 4	-
X coordinate's range used for pressure	e calculation: 0	00	averaging of the local coordinate system $\underline{}$	
✓ X component of pressure in pitching r	noment calculation	Estir	nated equivalent friction coefficient (F1-Help): 0.006	35
Compressible correction: 🔷 No	ne 🔷 Prandtl-Glau	ert 🔷 Karman	-Tsien 🐟 Direct (more time consuming)	

Fig. 20 – Dialog window of the PanProject program in the preparing data to SDSA mode

🔀 Panukl Project - YA.prj	-	×
File Project Create Help		
Simply project properties Parameters to prepare SDSA data set Run project for SDSA data		
Current computation process number		
Number of computational process left: 34		
Complete existing project @		
Save and Compute (O.K.) Save [,prj] file as Break the project	1	
	1	

Fig. 21 – Dialog window of the PanProject program in project run mode for SDSA

After setting all the parameters, go to the "Run project for SDSA data" tab (Fig. 21) and begin calculations with the "Save and compute (OK)" button. The project parameters are saved to the [.prj] file and the calculation procedure begins. The calculation progress is shown on two counter widgets. The first one shows the currently running last process (sequence of Panukl and Press programs), the second shows the number of sequences that remains to be performed. The "Break the project" button is used to stop calculations. The calculations can then be resumed at any time, even after the PanProject program is called again.

The PanProject program can be also used to compute a single sequence, similary as the PanAuto program. Calling a single sequence is possible after switching the program to the "Simply project properties" tab (Fig. 22). The "Create" menu options enable manual start of individual calculation steps, similar to the GridView program options. Dialog windows are available in the tabs Fig. 23.

🔀 Panukl Project - nowy.auto	-	×
File Project Create Help		
Simply project properties Parameters to prepare SDSA data set Run project for SDSA data		
Project [.auto] file: C:\Users\tgrab\PanuklProjects\sample\wings\nowy.auto	Browse	
Mesh [.ms2] file: C:\Users\tgrab\PanuklProjects\sample\wings\nowy.ms2	Browse	 •
Neigh [.ngh] file: C:IUsersitgrab\PanukiProjects\sample\wings\nowy.ngh	Browse	 $\checkmark$
Panukl [.par] file: C:\Users\tgrab\PanuklProjects\sample\wings\nowy.par	Browse	 •
Press [.prs] file: C:\Users\tgrab\PanuklProjects\sample\wings\nowy.prs	Browse	 V
Save and Compute (O.K.) Save (.auto) file as Clear	1	

Fig. 22 – Dialog window of PanProject program in one calculation sequence mode.

Proje	ect	Create	Help											
ate mes	h W	ake and	l neighbours	Doublet distribut	tion Pre	ess dist	tribution							
Neigh co	onfigt	ile (.ngh	]: C:\Users\t	grab\PanuklProje	cts\samp	ple\wing	gs\wing2.ng	gh				Bro	wse	
Inp	ut gri	d file (.in	p] C:\Users\t	grab/PanuklProje	ts\samp	ple\wing	gs\wing2.in	p				Bro	wse	
Outp	ut gri	d file (.da	at] C:\Users\t	grab\PanuklProje	ts\samp	ple\wing	js\wing2.da	at				Bro	wse	
													-	
40	1	railing e	edge angle (d	eg]:				N N	Wake ty	pe de	escription:			
60	_	leighbo	ur condition a	angle (deg):			0 - wake paralel to MAC 1 - wake with downwash due to angle of attack							
5	/	ngle of	attack [deg]:					4	2 - wake v 3 - wake p	vith do aralel	wnwash due to sideslip angle to the freestream			
0	\$	Bideslip	angle (deg):					4	4-6 - wake but or	e with f hly for l	the same effect as in cases 1-3 last wake panels			
20	— ı	.enght o	f the wake (la	ist panel - MAC mi	ultiplicati	ion)								
0	- \	Vake typ	e											
			Save and	Compute (O.K.)			Save [.ngl	h] file as			Clear			

Fig. 23 - Dialog window of one of the options (Wake and neighbours) of Create menu

Program can also run in the batch mode, using the following command:

#### PanProject [filename.auto/filename.prj] [iBatch]

where:

filename.auto/filename.prj – configuration file (see [6]) iBatch – batch mode flag (0/1).

Depending on the type of the input file, the program will run in simple sequence mode (file type [.auto]) or in the mode of preparing data for SDSA (file type [.prj]).

#### **Export FEM data for Calculix**

The command runs the configuration window of the **FEM** program (Fig. 24), which is used to export data and calculation results (pressure distributions) to the Calculix [4] program, which carries out strength analyzes using the finite element method. A detailed description of the operation and the manual of the program can be found in a separate document [5].

🗧 FEM export							—		×
*.inp/*.dat: C:	\Users\tgrab\Panuk	dProjects\sar	nple\wings	wing_auto.inp				Brows	e
*.txt: C:	\Users\tgrab\Panuk	dProjects\sar	nple\wings	\out\wing1_mod	dif.bxt			Brows	e
*.inp:								Brows	e
*.inertia:								Brows	e
Load 🔽	Revers I	V 20.0	m/s	ro 🔻 1.2	25 kg/	m3 Airj	plane Sym	nmetrical	•
CUT LE/TE Wall	BOUNDARY MATE	ERIAL ORIE	NTATION m Fusela	SHELL_SEC	OUTPUT	OMPUTE	Export ca	se setting	s
*SEC_Skin	Top_Wing0	11							_
у Е	LSET	MAT	OR	TH					
0 5	SkinTop_0	Mat	0	0.001					
1 5	SkinTop_1	Mat	0	0.001					
2 5	SkinTop_2	Mat	0	0.001					
3 5	SkinTop_3	Mat	0	0.001					
4 5	skinTop_4	Mat	0	0.001					
5 5	skinTop_5	Mat	0	0.001					
6 5	skinTop_6	Mat	0	0.001					
/ 5	skinTop_/	Mat	0	0.001					
0	kiniop_o	Mat	0	0.001					
10 6	kinTop_9	Mat	0	0.001					
□ Shell Fuse	lage	FEM mesh to	pe Shell S	84	•		Mesh La	ayers 3	-
Expor	t Mass	properties	C	Open File	Save	File		Close	

Fig. 24 – Dialog window of FEM program

#### **Connect two grids**

The command runs dialog window to configure and call Connect program (Fig. 25), which is used to connect two grids with vortex wakes [.dat].

input master gno ine Load Coosersi Eucasin anokodavdaotes Lo i dat						Browse
Input slave grid file [.dat] C:/Users/Lucas/Panukl/dat/dat/test_02.dat					Browse .	
Output gr	rid file [.dat] C/Users/	.ucas/Panukl/dat/dat/te	st_01_and_test_02.dat			Browse
	Master transfor	mation:		Slave transfo	ormation:	
Offset coordinate	s (in input master coo	dinates system):	Offset coordi	nates (in input master co	ordinates system)	
×o	Y: O	Z: O	× o	Y. O	Z: 0	
Rotation angles (	deg):		Rotation ang	les (deg):		
yaw: 0	pitch: 0	roll: 0	yaw: O	pitch: 0	roll: 0	
Rotation origin co	oordinates (in master o	oordinates system):	Rotation orig	in coordinates (in slave c	oordinates system	0:
×	Y: O	Z: O	X: O	Y: O	Z: 0	
Rotation origin op	otion:		Rotation orig	in option:		
user defined	© origin (0,0,0)	C MAC quarter	user defin	ed © origin (0,0,0)	© MAC quarter	r
			Reference values:			
Option:			Surface: 0	Wing span: 0	MAC: 0	
user defined	© master values	O slave values	Moment calculati	on origin 🗶 🛛	Z: O	
Save and	Compute (0.K.)	Ъ	Save [.con] file as		Cance	

Fig. 25 – Dialog window to configure the procedure of connection two grids

Thanks to this option, it is possible to create the complex grids consisting of more than one object and create unsymmetrical, complicated meshes. This option gives the user of the **PANUKL** package the possibility of, for example, analysis of the mutual aerodynamic impact of one object to

another (when two or more objects are in close neighbour - Fig. 26) or disconnection analysis, e.g. a fuel tank dropped from an airplane, etc.



Fig. 26 – What does CONNECT TWO GRIDS function do ?

# How it Works?

**Option 1** – we do have configuration [.con] file (Fig. 27)

Run **CONNECT TWO GRIDS** and select saved configuration file **[.con]** – file contains all necessary information to create **[.dat]** file (which will be an assembly of two existing grids). To open selected **[.con]** file click **OPEN** button. Configuration window will appear (Fig. 25) where one can see saved **[.dat]** file creation options. To generate **[.dat]** file click **Save and Compute (OK)** button.



Fig. 27 – Open the connection configuration file [.con]

#### Option 2 – we do not have configuration [.con] file

Run **CONNECT TWO GRIDS** and click **CANCEL** button when prompted for saved configuration file **[.con]**. The configuration window will appear (Fig. 28) where user can select options to create **[.dat]** file. To save current **[.dat]** creation options to **[.con]** file click **Save [.con] file as**, to create **[.dat]** file click **Save and Compute (OK)** button.

			1
	Input master grid file [.dat] [C:/Users/Lucas/Panukl/dat/dat/test_01.dat	Brow	/se
-	Input slave grid file [.dat] C/Users/Lucas/Panukl/dat/dat/dat/test_02.dat	Brow	/se
	Output grid file [.dat] C:/Users/Lucas/Panukl/dat/dat/test_01_and_1	test_02.dat Brow	/se
Ē	Master transformation:	Slave transformation:	_
	Offset coordinates (in input master coordinates system):	Offset coordinates (in input master coordinates system):	
	X: 0 Y: 0 Z: 0	X: 0 Y: 0 Z: 0	
	Rotation angles [deg]:	Rotation angles [deg]:	
	yaw: 0 pitch: 0 roll: 0	yaw: O pitch: O roll: O	
	Rotation origin coordinates (in master coordinates system):	Rotation origin coordinates (in slave coordinates system):	
	X: 0 Y: 0 Z: 0	X: 0 Y: 0 Z: 0	
	Rotation origin option:	Rotation origin option:	
	● user defined   ♡ origin (0,0,0)   ♡ MAC quarter	e user defined      origin (0,0,0)      O MAC quarter	
Ē	Reference	ce values:	_
	Option: Surface:	Wing span: 0 MAC: 0	-
	user defined     O master values     O slave values		-

for ex.: test\_01\_and\_test\_02.dat

Fig. 28 – CONNECT TWO GRIDS main options

Function		Description		
Offset coordinates (in input	Offset coordinates (in input master coordinates system) – X, Y, Z			
master coordinates system)	ו)			
Rotation angles [deg]	To rotate component enter the necessary rotation angles [deg].			
	Rotation origin can be defined as:			
	User defined –	defined by user,		
	Origin (0,0,0) –	the origin of coordinate system for current object,		
	MAC quarter –	¼ MAC for current aircraft.		
Reference values	User must specify	reference values for target output object:		
	User defined – d	efined by user,		
	Master values – re	ference values will be taken from master grid model		
	Slave values – re	ference values will be taken from slave grid model		

#### **Correct neighbours**

The command runs the dialog box (Fig. 29) to start the **Neigh\_con** program, which is used to correct "neighbours" for the already generated data file [.dat]. The neighbours correction program must be run if the grid connection procedure described in the previous chapter has been used.

<ul> <li>Output grid</li> </ul>	file [.dat] - output *.dat file name & path	(after correction) Brow
	Rewrite input data file on output	Neighbour condition angle [deg]: 60.0
Γ	Compute (O.K.)	Cancel

Fig. 29 – Dialog window of "Correct Neighbours" option

#### **Correct geometry**

The command runs the dialog box (Fig. 30) to start the Geom\_cor program, which is used to correct the panel geometry in the connection plane when creating a combined mesh of several components. The user must select the grid file with the neighbours (Input grid file) and the file to which the result grid is to be saved (Output grid file). In addition, it should be specified in which plane correction is to be made by specifying the type (three possibilities: X - YZ plane, Y - XZ plane, Z - XY plane) and the exact coordinate value. The position of nodes located in this plane is adjusted so as to obtain the consistency of the grid.

Seometry correction —	o x	
Input grid file [.dat] C:\Users\tgrab\PanukiProjects\AT61\at6_caly.dat	Browse	
Output grid file [.dat] C:\Users\tgrab\Panuk\Projects\AT61\at6_caly_new.dat		
Rewrite input data file on output     Coordinate: Y     value of coordinate -1.71		
Compute (O.K.) Cancel		

Fig. 30 – Dialog window of "Correct geometry" option



Fig. 31 – Geometry correction in the central plane of engine nacelle: a – before correction, b – after correction

Note: The "Correct geometry" option is considered at the present stage as experimental and should be used with caution due to the possibility of "holes" in the surface of the plane (open panels).

# **XFOIL** menu description

🗼 Р	anukl 20	118 - Grid	d viewer							-		×
File	View	Data	Create	Xfoil	Tools	Help						
				Intera	ctive mod	de						
				Intera	ctive mod	de for stored wing s	ection geometry					
				Polar	calculation	on						
				Open	Xfoil pola	ar						
				Show	drag pol	ar						
				Show	lift coeffi	cient						
				Show	moment	t coefficient						
				Show	polar cal	Iculation results						
				Conve	rsion .pr	f -> xfoil						
				Conve	rsion xfo	oil -> .prf						
				Xfoil o	ptions		•	Xfoil program				
								Hide Xfoil co	nsole (pol	ar calc	ulation)	
Statu	s: no da	ta										

Fig. 32 – Menu – XFOIL

In the **XFOIL** menu, the user will find the most important functions to facilitate the aerodynamic analysis of the profiles using an external **XFOIL** program. In order to correctly use and interpret the obtained results, a basic knowledge of the **XFOIL** program is required..

#### **Calculation options**

Function	Description
Interactive mode	Click to run external <b>XFOIL</b> program. Standard program window will appear
Interactive mode for stored wing section geometry	Run the external XFOIL program for the selected file <b>[.dat]</b> containing a profile geometry data that will be subjected to aerodynamic analysis (Fig. 34).
Polar calculation	Computing the basic aerodynamic characteristics for an airfoil: <b>CL-lift, CD-drag, CM-moment</b> , versus <b>angle of attack</b> and <b>Reynolds</b> & <b>Mach</b> number. (airfoil geometry saved to [.dat] file). Results of calculation of the aerodynamic characteristics are saved to [.txt] file (Fig. 33).



Fig. 33 – Polar calculations setup window



Fig. 34 – External XFOIL program window and airfoil [.dat] file selection window



Fig. 35 – XFOIL window – aerodynamic coefficients computations for an airfoil

During **XFOIL** aerodynamic computations user must check if results converge. Otherwise obtained results can have no physical sense. For more information go to **XFOIL** manual.

## **Preview options for results**

Funkcja/ Polecenie	Opis
	Loading the file with saved aerodynamic characteristics of the profile
Open XFOIL polar	from the selected location on the disk, Fig. 36. After loading the data
	file [.txt], the following commands become active:
Show Drag polar	Displays a window with drag characteristic CD , Fig. 37.
Show Lift coefficient	Displays a window with lift characteristic <b>CL</b> , Fig. 37.
Show Moment coefficient	Displays a window with moment characteristic <b>CM</b> , Fig. 37.



Fig. 36 – Selecting result file with aerodynamic characteristics for an airfoil



Fig. 37 – Example results CL, CD, CM versus Angle of Attack

# **Tool options**

Funkcja/ Polecenie	Opis
Conversion [.prf] to XFOIL	Option to convert a [.prf] file containing a profile geometry definition in the native format for the PANUKL program to [.dat] format accepted by XFOIL, Fig. 38.
Conversion XFOIL to [.prf	Option to convert a [.dat] file containing a profile geometry definition in a format accepted by the XFOIL program to the [.prf] format native to the PANUKL program, Fig. 38.
Xfoil options	<ul> <li>The option contains two additional program settings XFOIL:</li> <li>Xfoil program – sets the location of the Xfoil executable file; the default is to set the program distributed with the package, however, the user can use the program installed separately or located in the operating system distribution (Linux).</li> <li>Hide Xfoil console (polar calculation) – the Xfoil program, which is running for the polar calculation of the profile, opens the window of the console on which it shows the course of calculations; this option hides the console window and calculations take place in the background.</li> </ul>

# file conversion \*.PRF - PANUKL to \*.DAT - XFOIL

Wing section data conversion (PANUKL -> XFOIL)		
Panukl wing section file [.prt] C:/Users/Lucas/Panukl/dat/profile/naca65009.prf - *.prf file path		Browse
Xfoil labeled data file [.dat] C:/Users/Lucas/Panukl/dat/xfoil/naca65009.dat - *.dat file path		Browse
Wing section name NACA65009 - airfoil name (type here)		
0.K.	Cancel	

# file conversion \*.DAT - XFOIL to \*.PRF - PANUKL

Wing section data conversion (XFC	JIL -> PANUKL)			
Xfoil labeled data file [.dat]:	C:/Users/Lucas/Panukl/dath/oil/naca65009.dat - *.dat file path	Browse		
Panukl wing section file [.prf]:	ion file (.prf): C:/Users/Lucas/Panukl/dat/profile/naca65009.prf - *.prf file path Brows			
Wing section name:	naca65009、- airfoil name which is converted (loaded from *.dat file)			
	O.K. Cancel			

Fig. 38 – Airfoil file type conversion

# **TOOLS** menu description



Fig. 39 - TOOLS

#### **Files location**

This option displays a dialog box in which the user can change the settings regarding the location and names of the folders in which the input data is stored, the results obtained and other files related to the operation of the package (Fig. 40).

/PanukIProjects/dat/ dat fuselage inp mesh neigh panukI press	Browse For Folder     X       Select data files directory: <ul> <li>PanuklProjects</li> <li>Aramis</li> <li>AT6_1</li> <li>AT61</li> <li>AT61</li> <li>ATar</li> </ul> Eolder:     AT61           Make New Folder         OK
Executable files directory: C:\Program Files\Panukl	- executable files data path Browse
Project data files directory: C:\Users\tgrab\PanuklProjects\AT61\	- input data files path Browse
I Data files subdirectories Cre	aate subdirs
Output files directory: C:\Users\tgrab\PanuklProjects\AT61\	- output (result) files path Browse
Define Calculix directory	
Calculix working directory: C:\Users\tgrab\PanuklProjects\AT61\	Browse
Sample data files directory: C:\Users\tgrab\PanuklProjects\sample	e\ Browse
Select sample: Wings Se	t directories
Panukl profiles library: C:\Program Files\Panukl\data\profile\	Browse
User profiles library: C:\Users\tgrab\PanuklProjects\profile\	Browse
O.K. (Apply)	Save Cancel

Fig. 40 – Files location selection window

The user must set up the directories for the data files (Project data files directory) and for the output files (Output files directory). It can be the same directory (project directory) or different specialized catalogs. The user can choose specialized subdirectories for data files:

- script files to mesh generation subdirectory mesh
- fuselage geometry files subdirectory fuselage
- files containing the mesh created by Mesh3 program subdirectory inp
- configuration files for Neigh program [.ngh] subdirectory neigh
- files containing the mesh with the vortex wake subdirectory dat
- configuration files for Panukl program [.par] subdirectory panukl
- configuration files for Press program [.prs] subdirectory press

Click **CREATE SUBDIRS** button to automatically create proper directory structure for **PANUKL**'s input and output data. . Click **SAVE** button to save options

#### **Image options**

The option displays a dialog box with options on how to display the model in the graphics window (Fig. 41).

Noptions — 🗆 X	
Range of panel numbers     100000     Vortex wake visible     Show Objects     Select Objects      Pressure distribution     Auto show     Smoothing Pressure distribution     o flat     o triangles	<ul> <li>range of visible panels</li> <li>wake visible</li> <li>show selected objects</li> <li>pressure distribution visible (if computed)</li> <li>show the pressure distribution automatically after reading the file</li> <li>enabling smoothing of pressure distribution colors</li> </ul>
	<ul> <li>shading enabled</li> <li>contru lines visible</li> <li>results color scale visible</li> <li>change background color to white</li> <li>hide invisible edges</li> <li>antialiasing</li> <li>set width of displayed lines</li> <li>front line offset</li> <li>display aspect ratio</li> </ul>
Init option: default Fit to window on init (up view) Saved custom position	<ul> <li>→ initial view options</li> <li>→ default - top view on the original scale</li> <li>→ top view fitted to window</li> <li>→ saved custom view - (F6)</li> </ul>
Close Save	save current options



#### **Color map**

The option displays a dialog window in which the user can change and set the way in which the results of distributions, eg pressure, speed, etc., will be presented (Fig. 42).



Fig. 42 – Graphic representation of results - setup window

#### JPEG parameters

The option displays the window where user can adjust **JPEG** picture capture quality and options (Fig. 43).



save options button

Fig. 43 – JPEG screen capture setup window

#### Save Options (Shift+Ctrl+S)

Click to save current options of PANUKL package.

# **HELP menu description**

File View Data Create Xfoil Tools Help	
Help system General Help menu F1	
Manual language   Theoretical basis	
PDF reader selection  Brief description of programs	
Xfoil Manual F3 Data, configuration and output files	
Panukl web site Installation of the package	
About User manual Shift-F1 MS2 Editor	
Tutorial FEM export	
Examples Fuselage data	

Fig. 44 – Menu – HELP

# HELP menu – available options

Function	Description
Help system (F1)	General Help menu
Manual language	Help language (available: <b>PL</b> i <b>ENG</b> )
PDF reader selection	PDF document reader application selection.
Xfoil Manual (F3)	XFOIL manual [3]
Panukl web site	PANUKL home webpage
About	Click to display about PANUKL window, Fig. 45.



Fig. 45 – Information window

#### Help system

The help system includes a main help file that contains general information about the package and links to individual documentation files. The entire documentation includes theoretical foundations, a description of basic functionalities and methods of use as well as examples of application. The help system includes:

- <u>General Help menu</u> (F1)
- <u>Theoretical basis</u>
- Brief description of the package components (programs)
- Data, configuration and output files
- Installation of the package
- <u>User manual</u> (Shift F1 this document)
  - MS2 editor MS2 editor description
  - FEM export export of data and results to Calculix [4]
  - <u>Fuselage data</u> description of program to import fuselage data from NX
- <u>Tutorial</u>
- <u>Examples</u> description of the samples included in the package

# References

- [1] MS2 editor description
- [2] Fuselage program description
- [3] Drela M., (2017) Xfoil Subsonic Airfoil Development System, <u>http://web.mit.edu/drela/Public/web/xfoil/</u>
- [4] CALCULIX A Free Software Three-Dimensional Structural Finite Element Program, <u>http://www.calculix.de/</u>
- [5] FEMexport program description
- [6] Data, configuration and output files
- [7] Goetzendorf-Grabowski T., (2018), Simulation and Dynamic Stability Analysis, https://www.meil.pw.edu.pl/add/ADD/Teaching/Software/SDSA