



MODELOWANIE W *POWERSIM*

**Wprowadzenie do projektowania
modeli własnych**



Plan



Diagramy modeli



Definiowanie zmiennych



Wybór ustawień dla symulacji



Wyniki symulacji – tabele



Wyniki symulacji – wykresy



Interaktywny proces symulacji

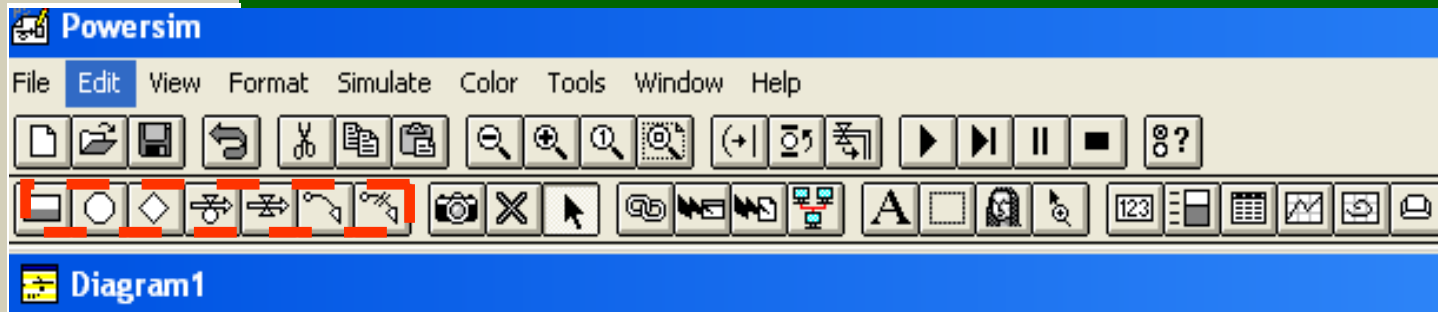


Interaktywne zmiany parametrów



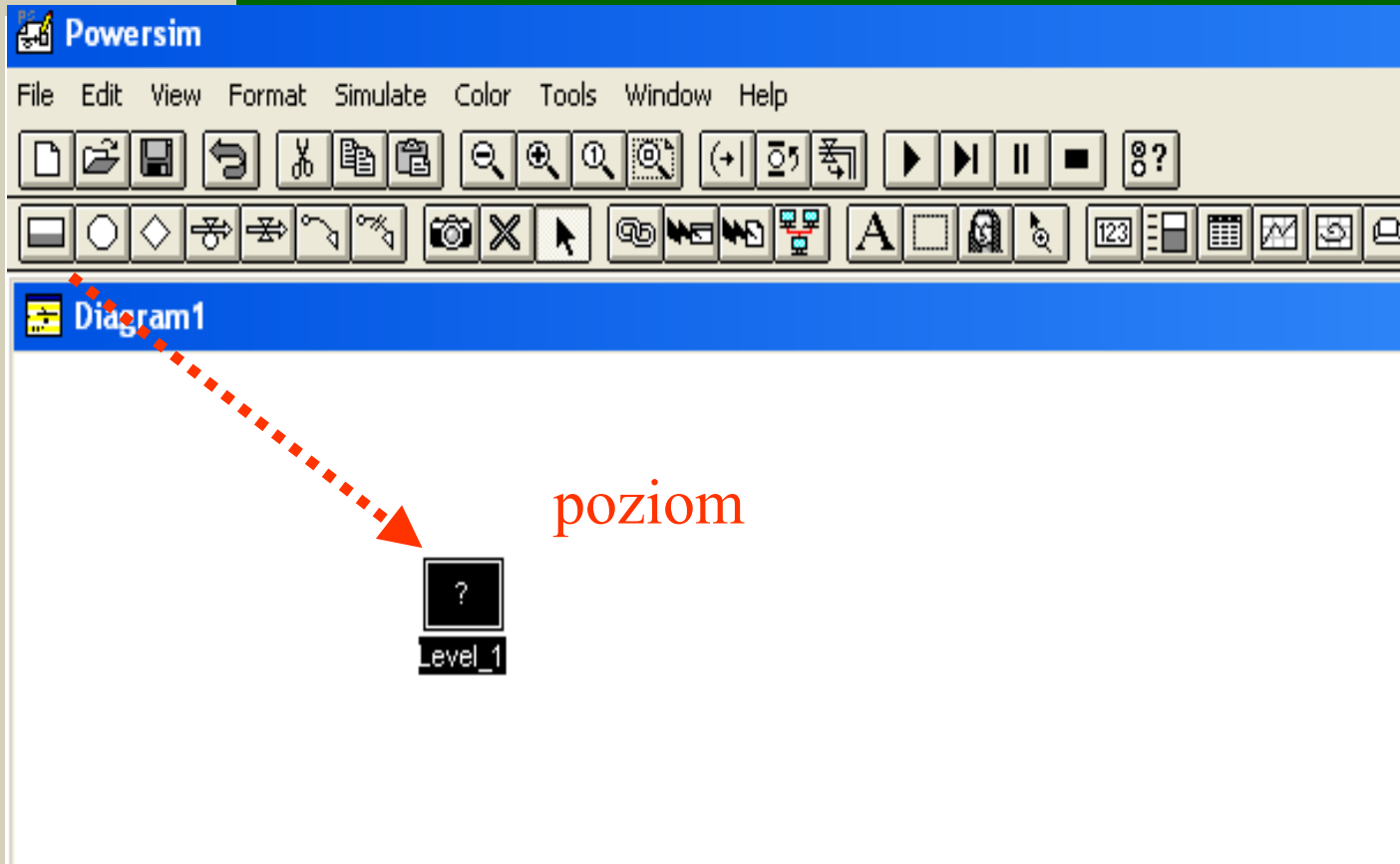
Budowanie diagramów modeli

Budowanie diagramów

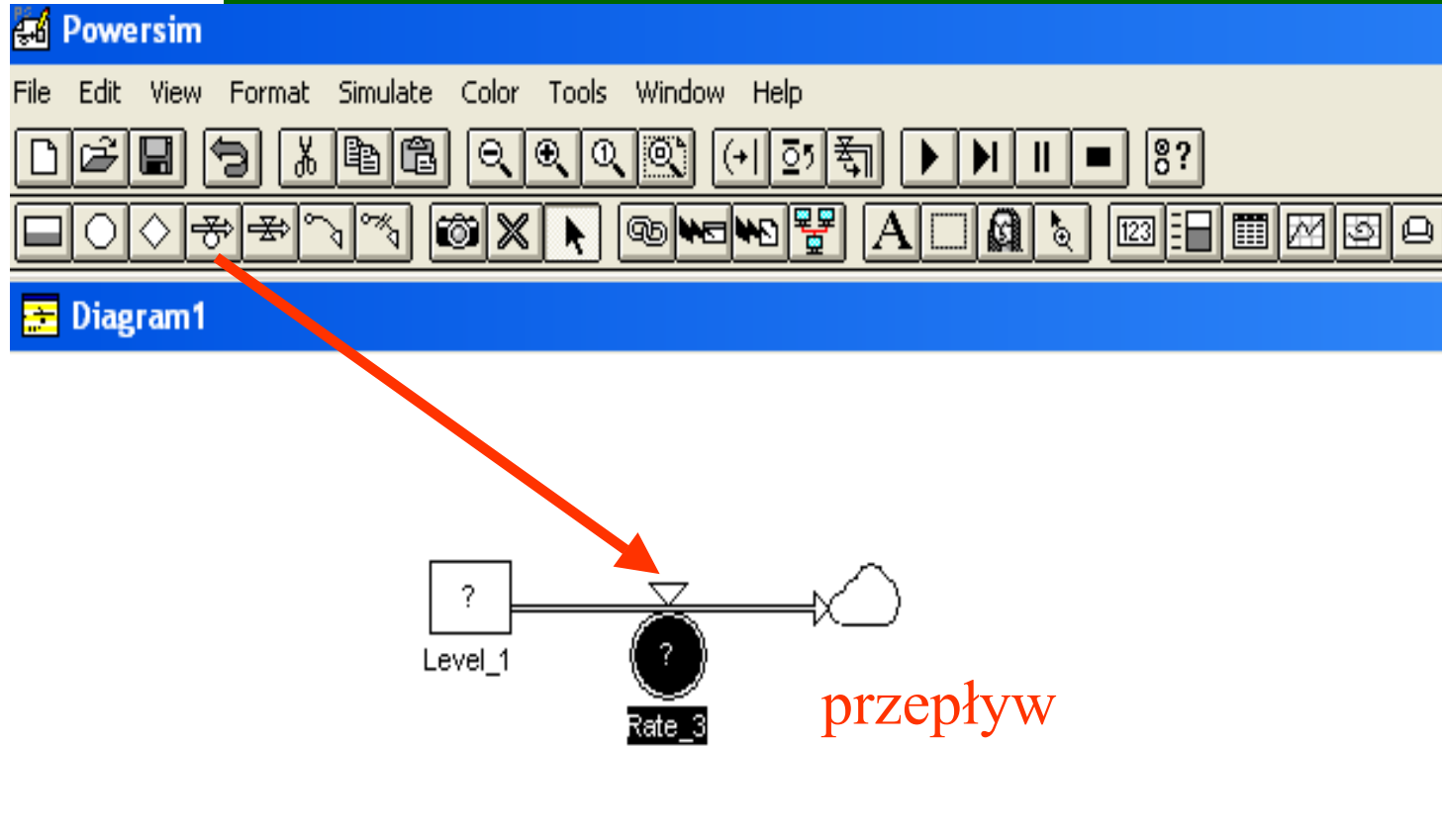


Ekran projektowania

Budowanie diagramów



Budowanie diagramów



The screenshot shows the Powersim software interface. The title bar reads "Powersim". The menu bar includes "File", "Edit", "View", "Format", "Simulate", "Color", "Tools", "Window", and "Help". Below the menu bar is a toolbar with various icons for file operations, simulation control, and diagram editing. The main window title is "Diagram1". A red arrow points from a flow rate icon in the toolbar to a diagram element. The diagram consists of a rectangular box labeled "Level_1" containing a question mark, connected by a horizontal line to a triangular flow rate symbol. Below this symbol is a circular component labeled "Rate_3" with a question mark inside. The word "przepływ" (flow) is written in red text to the right of the diagram.

Budowanie diagramów

The screenshot shows the Powersim software interface. The title bar reads "Powersim". The menu bar includes "File", "Edit", "View", "Format", "Simulate", "Color", "Tools", "Window", and "Help". Below the menu bar is a toolbar with various icons for file operations, simulation control, and diagram editing. The main window is titled "Diagram1" and contains a diagram with the following elements:

- A square box labeled "Level_1" containing a question mark.
- A circular box labeled "Rate_3" containing a question mark.
- A cloud-shaped output symbol.
- A diamond-shaped box labeled "Constant_2" containing a question mark, which is highlighted with a red arrow pointing from the toolbar.

The word "stała" (constant) is written in red text next to the "Constant_2" symbol.

Budowanie diagramów

The screenshot displays the Powersim software interface. The title bar reads "Powersim". The menu bar includes "File", "Edit", "View", "Format", "Simulate", "Color", "Tools", "Window", and "Help". Below the menu bar is a toolbar with various icons for file operations, simulation control, and diagram editing. The main window is titled "Diagram1" and contains a diagram with the following elements:

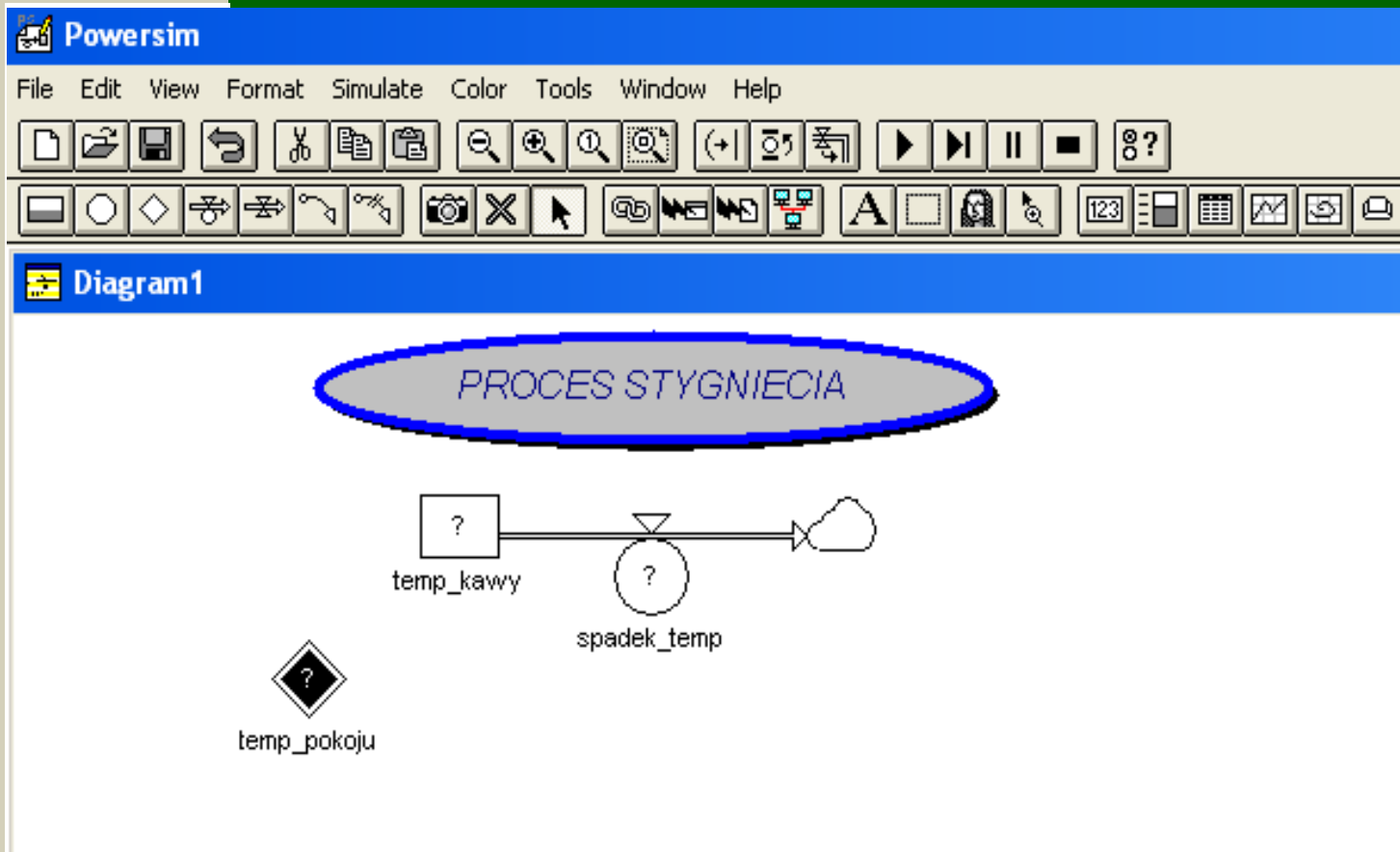
- A diamond-shaped block labeled "Constant_2" with a question mark inside. A red arrow points from the diamond icon in the toolbar to this block.
- A rectangular block labeled "Level_1" with a question mark inside.
- A circular block labeled "Rate_3" with a question mark inside.
- A horizontal line connecting "Level_1" to "Rate_3".
- A cloud-shaped output symbol connected to "Rate_3".

The word "stała" is written in red text next to the "Constant_2" block.

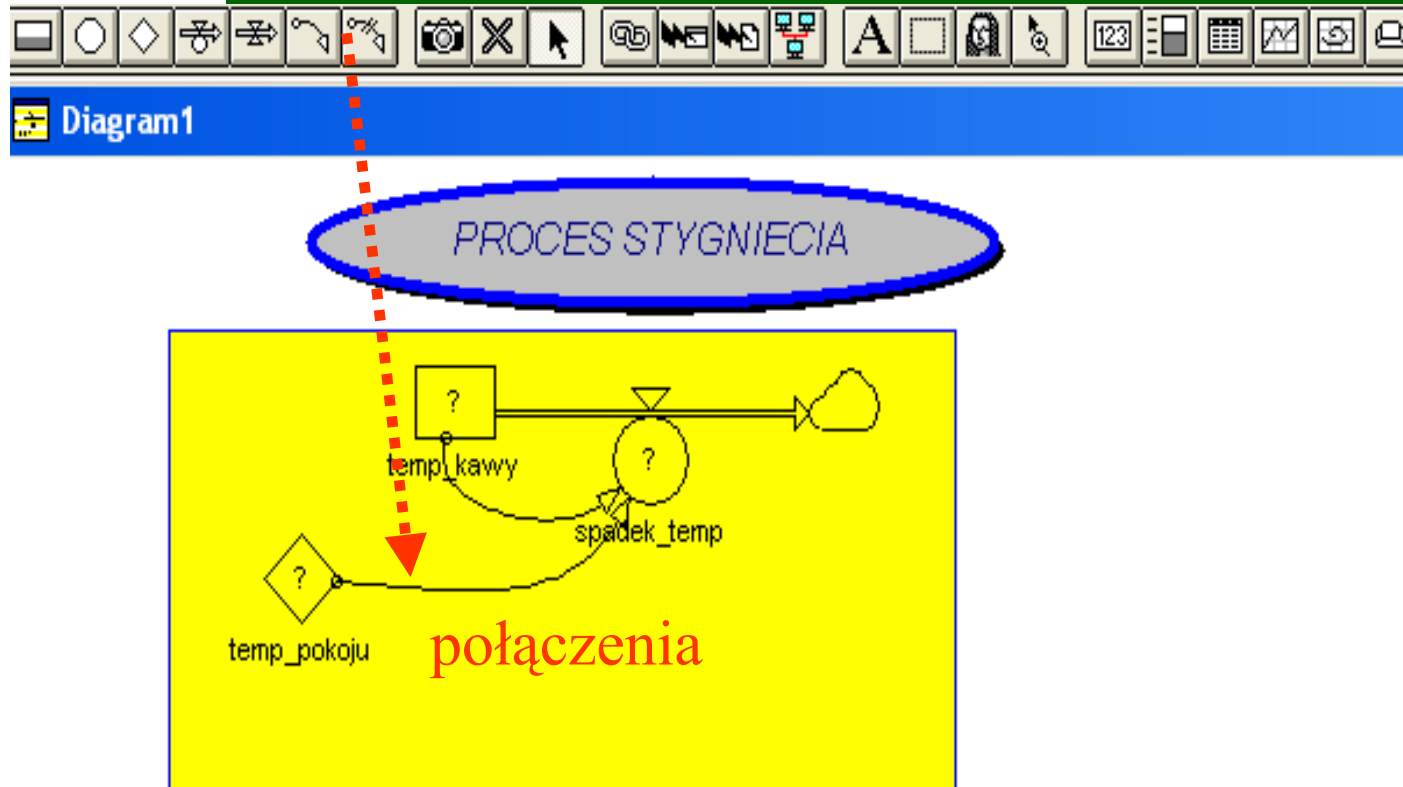
Budowanie diagramów

The screenshot displays the Powersim software interface. The main window is titled "Diagram1" and contains a diagram. At the top, there is a menu bar with "File", "Edit", "View", "Format", "Simulate", "Color", "Tools", "Window", and "Help". Below the menu bar is a toolbar with various icons for file operations, editing, simulation, and diagram creation. A red dashed arrow points from the text tool icon in the toolbar to a grey oval with a blue border and a dotted selection box. The oval contains the text "PROCES STYGNIECIA". Below the oval is a process flow diagram consisting of a rectangular box labeled "Level_1" with a question mark inside, connected by a horizontal line to a circular box labeled "Rate_3" with a question mark inside. A downward-pointing arrow is attached to the right side of the "Rate_3" box, leading to a cloud-like shape. To the left of the "Rate_3" box is a diamond-shaped box labeled "Constant_2" with a question mark inside.

Budowanie diagramów



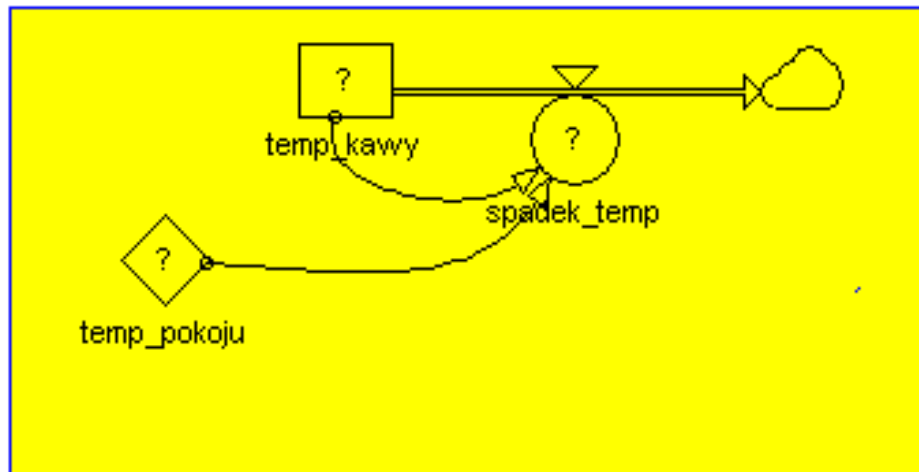
Budowanie diagramów



Budowanie diagramów

Diagram1

PROCES STYGNIECIA





Definiowanie zmiennych

Definiowanie zmiennych

Define Variable [X]

Variable: Selected Only Unit of Measure:

temp_pokoju

Dimensions:

Definition: Full View

Documentation:

Linked Variables: Functions:

ABS
ABSC
ADD
ADDCR
ADDRC

Ranges: Units: Function Group:

{All} Paste Func Arguments

OK Cancel Set Locate Graph... Less <<

()	E	-
7	8	9	+
4	5	6	/
1	2	3	*
0	.	^	
<	>	[]
,		=	:
<--	<-	->	
✂	📄	📁	↶

Definiowanie zmiennych

The image shows a software interface with a process diagram on the left and a 'Define Variable' dialog box on the right.

Process Diagram: A flowchart titled 'PROCES STYGNIECIA' (Cooling Process) is shown on a yellow background. It includes several nodes: a diamond-shaped node labeled 'temp_pokoju', a rectangular node labeled 'temp_kawy', a circular node labeled 'spadek_temp', and a cloud-shaped node. Arrows indicate the flow between these nodes.

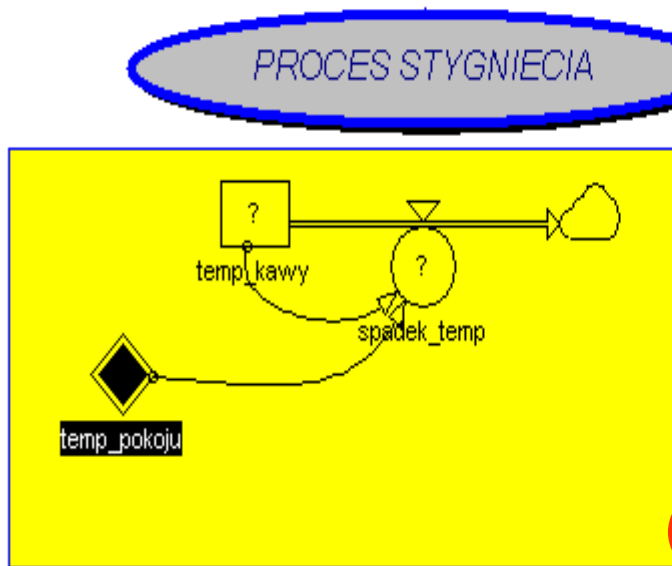
Define Variable Dialog Box: The dialog box is titled 'Define Variable' and contains the following fields and options:

- Variable:** A dropdown menu showing 'temp_pokoju'. There is a checkbox for 'Selected Only' which is currently unchecked.
- Unit of Measure:** An empty text field.
- Dimensions:** An empty text field.
- Definition:** An empty text area.
- Documentation:** An empty text area with scrollbars.
- Linked Variables:** An empty list box.
- Functions:** A list box containing 'ABS', 'ABSC', 'ADD', 'ADDCR', and 'ADDRC'.
- Ranges:** An empty text field.
- Units:** An empty text field.
- Function Group:** A dropdown menu showing '{All}'.
- Paste Func Arguments:** A checked checkbox.

At the bottom of the dialog box, there are buttons for 'OK', 'Cancel', 'Set', 'Locate', 'Graph...', and 'Less <<'.

Definiowanie zmiennych

Diagram1



Define Variable

Variable: Selected Only

temp_pokoju

Dimensions:

Definition:

22

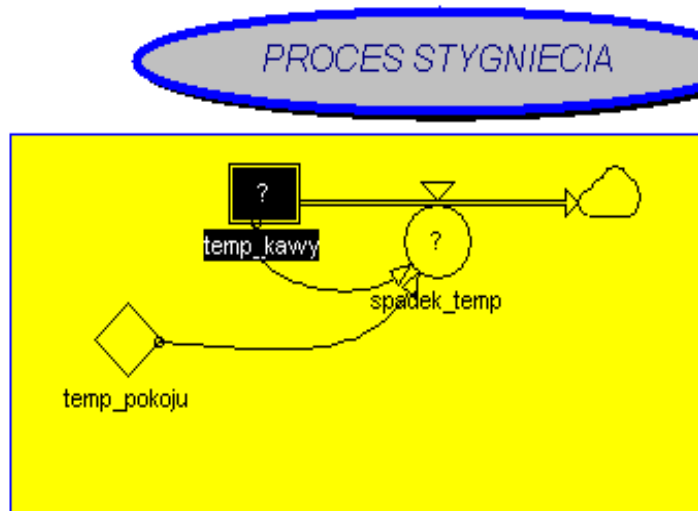
Documentation:

temperatura otoczenia w stopniach Celsusza

Linked Variables:

Definiowanie zmiennych

Diagram1



Define Variable

Variable: Selected Only

? temp_kawy

Dimensions:

Definition: Initial Flow

Documentation:

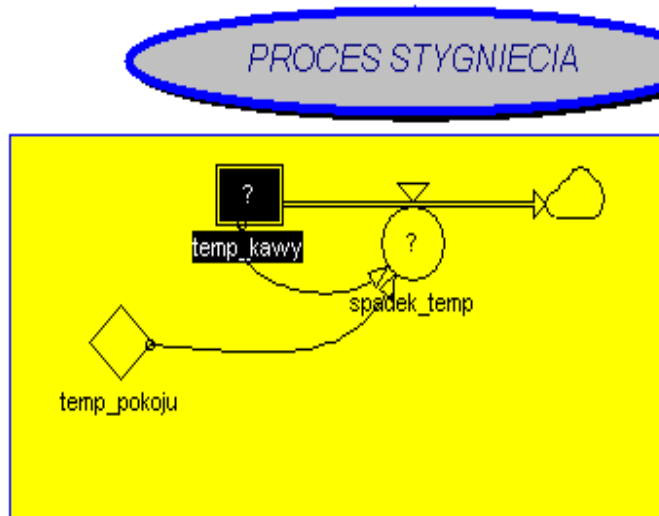
Linked Variables:

Ranges:

Units:

Definiowanie zmiennych

Diagram1



Define Variable

Variable:

Selected Only

Unit of Measure:

? temp_kawy

Dimensions:

Definition:

Initial

Flow

83

Documentation:

początkowa temperatura kawy w stopniach Celsjusza

Linked Variables:

Functions:

ABS
ABSC
ADD
ADDCR
ADDRC

Ranges:

Units:

Function Group:

Definiowanie zmiennych

Diagram1

PROCES STYGNIĘCIA

temp_kawy

spadek_temp

temp_pokoju

Define Variable

Variable: Selected Only Unit of Measure:

? temp_kawy

Dimensions:

Definition: Initial Flow

-dt*(spadek_temp)

Documentation:

początkowa temperatura kawy w stopniach Celsjusza

Linked Variables:

Functions:

- ABS
- ABSC
- ADD
- ADDCR
- ADDRC

Ranges: Units: Function Group:

Definiowanie zmiennych

Diagram1

PROCES STYGNIECIA

The diagram shows a process flow for 'PROCES STYGNIECIA'. It includes three variables: 'temp_kawy' (represented by a square), 'temp_pokoju' (represented by a diamond), and 'spadek_temp' (represented by a circle with a question mark). Arrows indicate the flow between these variables.

Define Variable

Selected Only Unit of Measure:

Variable:

Dimensions:

Definition:

Documentation:

Linked Variables:

- temp_kawy
- temp_pokoju

Functions:

- ABS
- ABSC
- ADD
- ADDCR
- ADDRC

Ranges: **Units:** **Function Group:**

Definiowanie zmiennych

Diagram1

PROCES STYGNIECIA

temp_kawy

temp_pokoju

spadek_temp

Define Variable

Variable: Selected Only Unit of Measure:

Dimensions:

Definition: $(temp_kawy - temp_pokoju) / 12$

Documentation:

Linked Variables:

- temp_kawy
- temp_pokoju

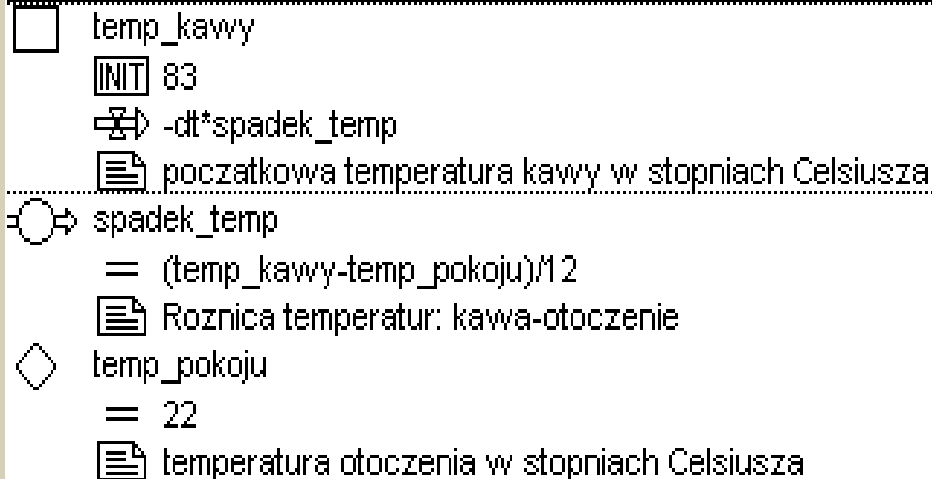
Functions:

- ABS
- ABSC
- ADD
- ADDCR
- ADDRC

Ranges: Units: Function Group:

Równania w pseudokodzie

Diagram1





Wybór ustawień symulacji

Wybór ustawień symulacji

Diagram1

- temp_kawwy
- INIT 83
- dt*spadek_temp
- poczatkowa temperatura kawwy w
- spadek_temp
 - = (temp_kawwy-temp_pokoju)/12
- Roznica temperatur: kawa-otocz
- temp_pokoju
 - = 22
- temperatura otoczenia w stopnia

Simulation Setup

Model(s): Main

Times

Start Time: 0,00

Stop Time: 100,00

Time Unit:

Integration

Method: Euler (fixed step)

Time Step: 1,00

Abs Error:

Rel Error:

OK

Cancel

Set

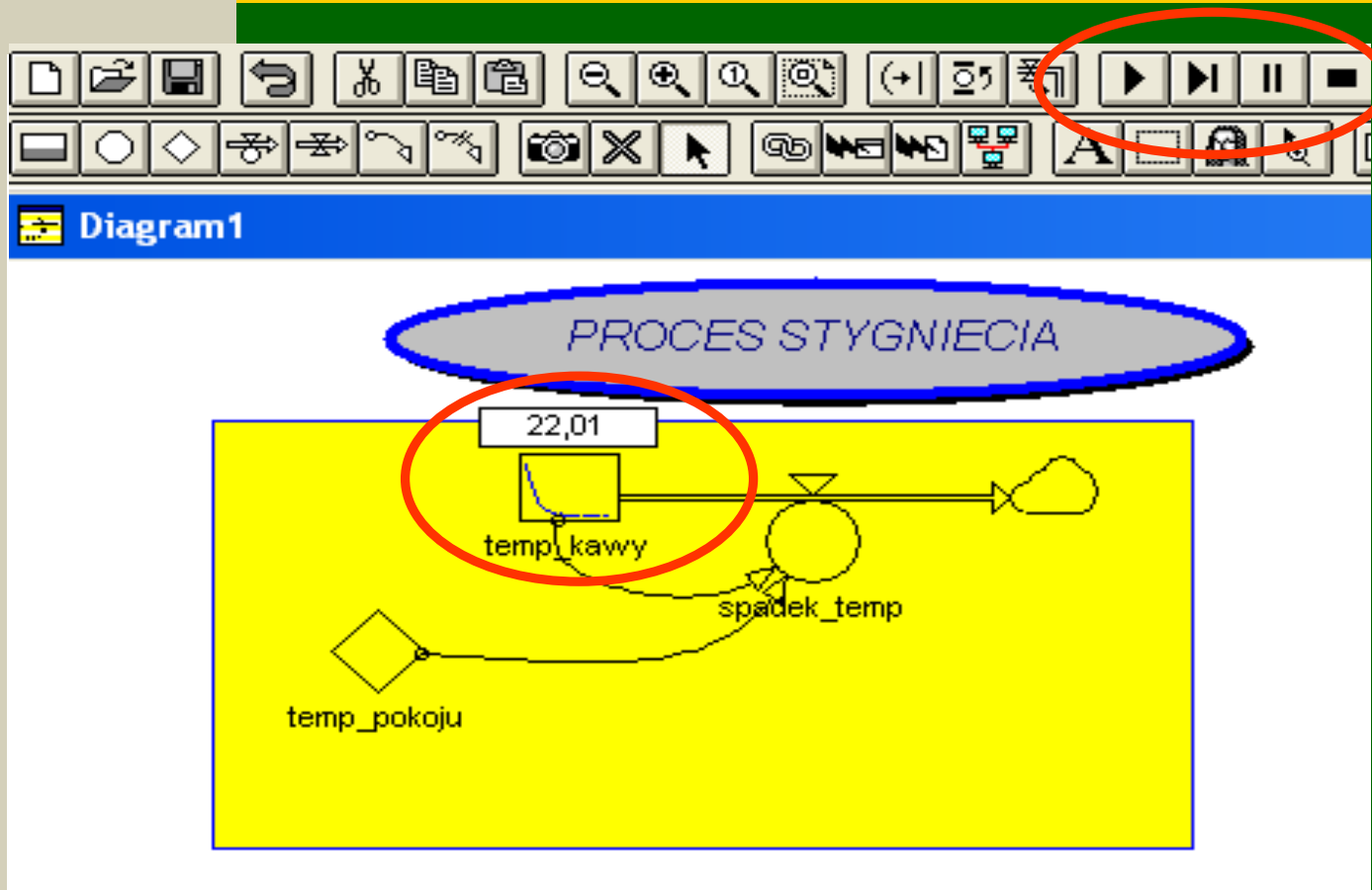
Co-models <<

Parallel Simulation

Model	Time Step	Start Time	Stop Time
Main	1,00	0,00	100,00

Add... Remove Rename... Open

Uruchamianie symulacji





Wyniki symulacji – tabele

Generowanie tabel

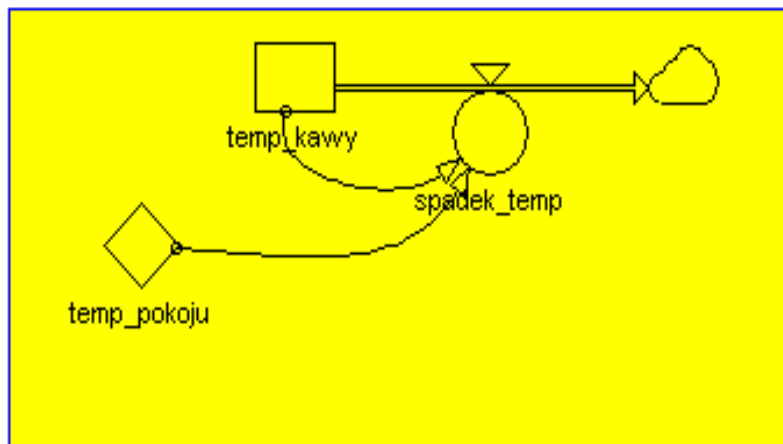
The screenshot shows a simulation software interface with a toolbar at the top. The title bar reads "...\Pulpit\MODEL04\WYKLAD4.SIM". Below the toolbar, a blue oval contains the text "PROCES STYGNIECIA". A yellow rectangular area contains a process diagram with three nodes: a square labeled "temp_kawy", a diamond labeled "temp_pokoju", and a circle labeled "spadek_temp". A red dashed arrow points from the "spadek_temp" node to a data table. The table has three columns: "TIME", "temp_kawy", and "spadek". The rows are numbered 0 to 7. A red arrow points to the cell at row 1, column "spadek".

TIME	temp_kawy	spadek
0		
1		
2		
3		
4		
5		
6		
7		

Generowanie tabel

..1..PulpitMODEL04\WYKLAD4.SIM

PROCES STYGNIECIA

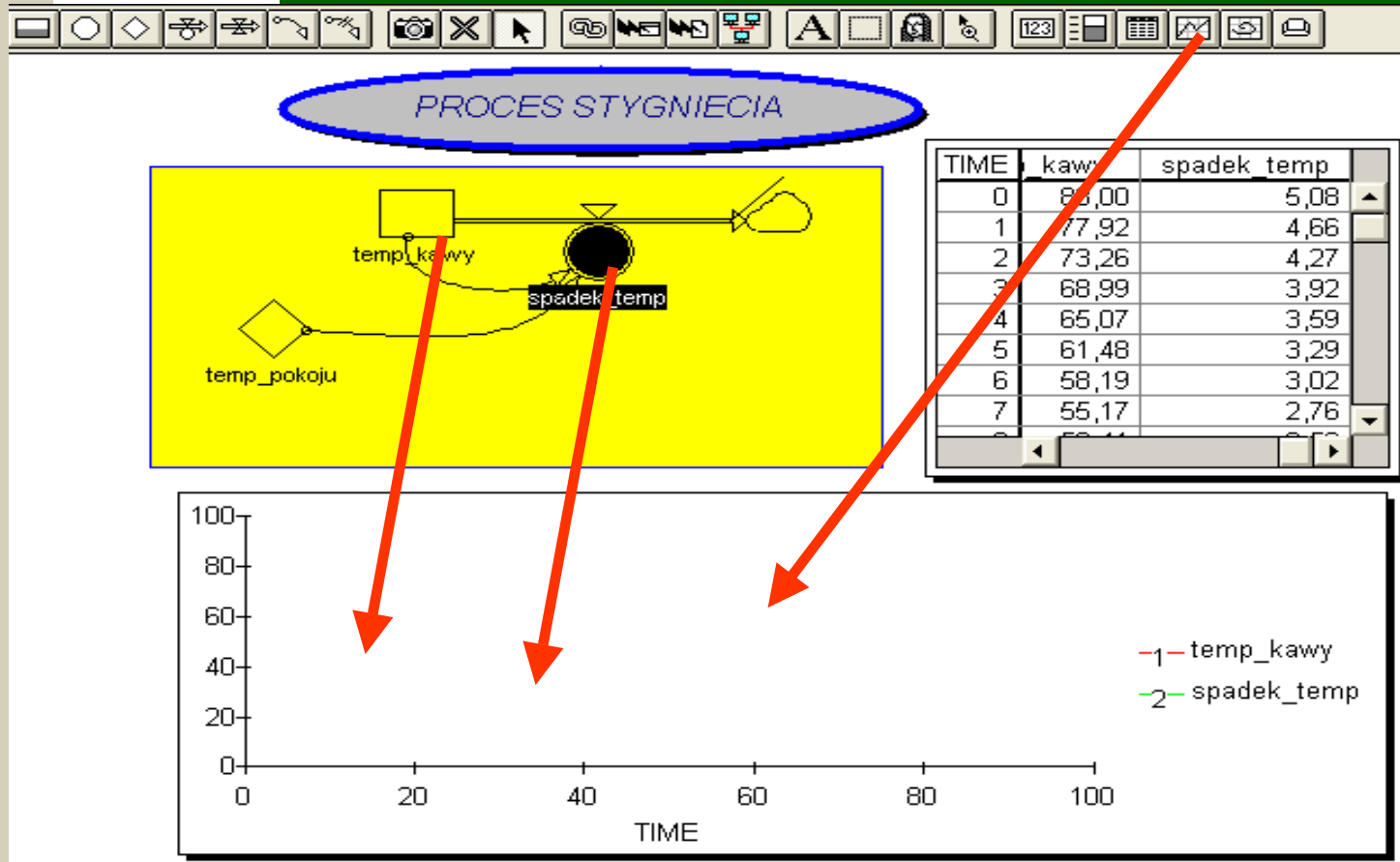


TIME	kawy	spadek temp
0	83,00	5,08
1	77,92	4,66
2	73,26	4,27
3	68,99	3,92
4	65,07	3,59
5	61,48	3,29
6	58,19	3,02
7	55,17	2,76



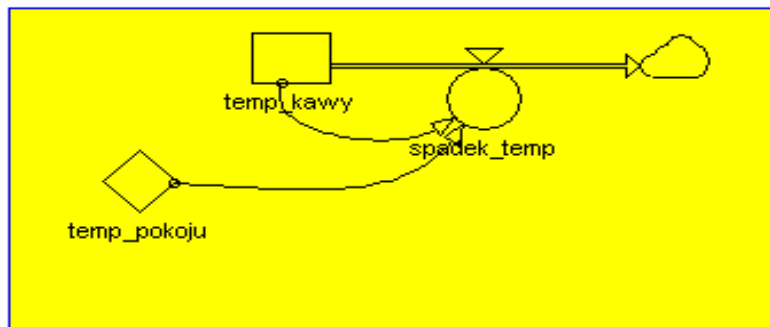
Wyniki symulacji – wykresy

Generowanie wykresów

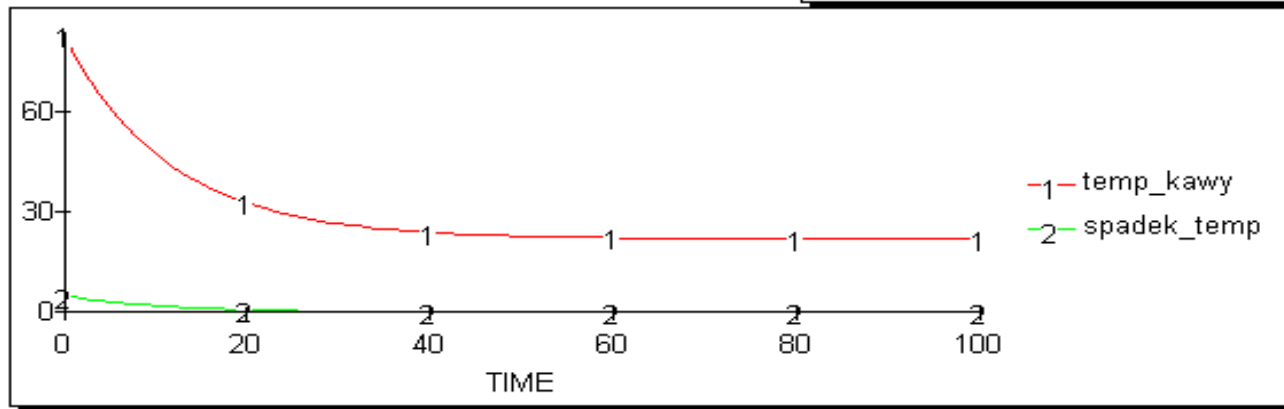


Generowanie wykresów

PROCES STYGNIECIA



TIME	kawy	spadek temp
43	23,45	0,121
44	23,33	0,111
45	23,22	0,101
46	23,11	0,0929
47	23,02	0,0851
48	22,94	0,078
49	22,86	0,0715
50	22,79	0,0656



Generowanie wykresów

PROCES STYGNIECIA

TIME | kaww | spadek temp

Define Time Graph

Models:
Main

Variables:
 temp_kawy
 spadek_temp
 temp_pokoju

Parameters:
 temp_kawy
 spadek_temp

Time (X) axis:
Axis...
Minor Grid...
Major Grid...

Value (Y) axis:
Axis...
Minor Grid...
Major Grid...
 Labeled Scales

Drawing:
 Line
 Marker
 Area
Custom...

View:
Based

Display...
Generations...
1 Background...
2 Graph Area...
3 Title...
4 Legend...
5 Gen Legend...
6 Hi-Lo Lines...
7 Drop Lines...

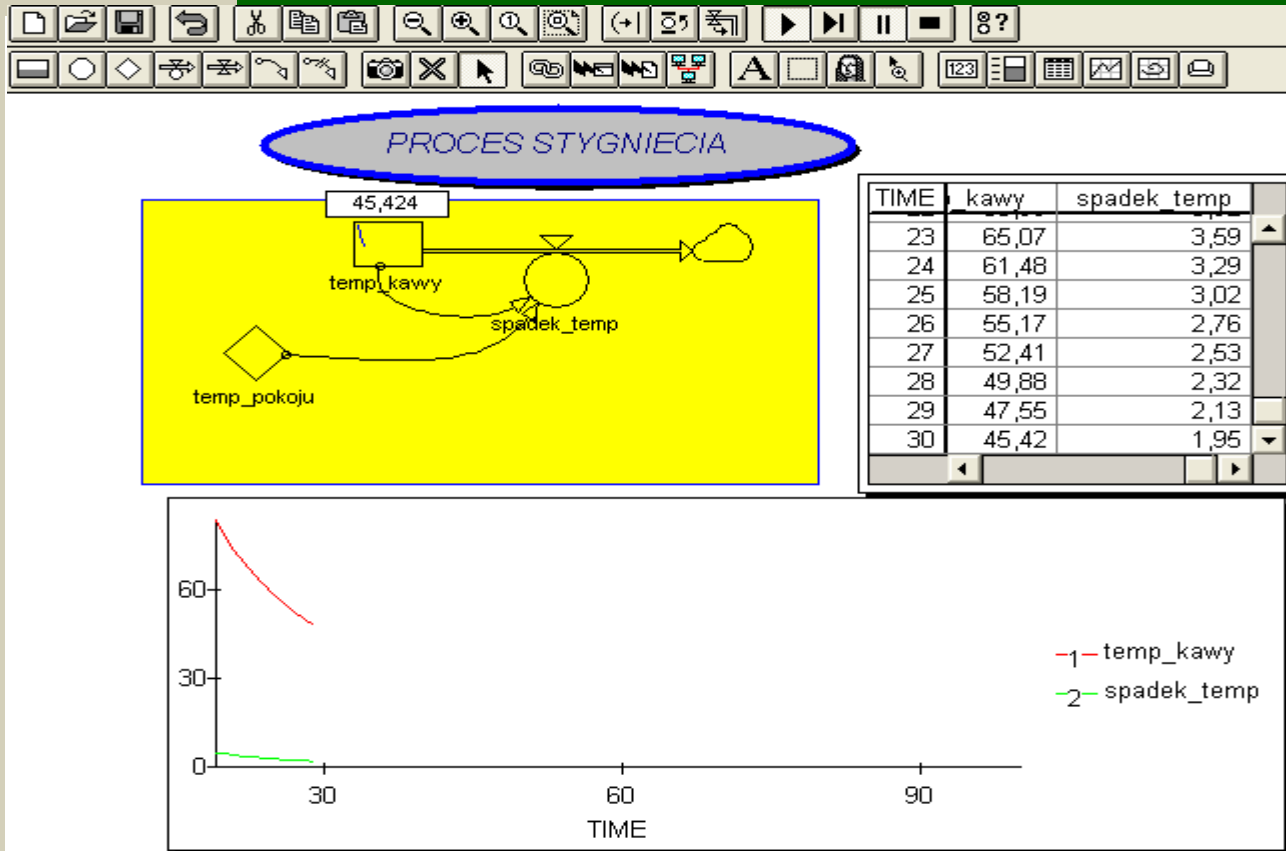
Save Limit (pts):
8001

OK
Cancel
Help



Interaktywne symulacje

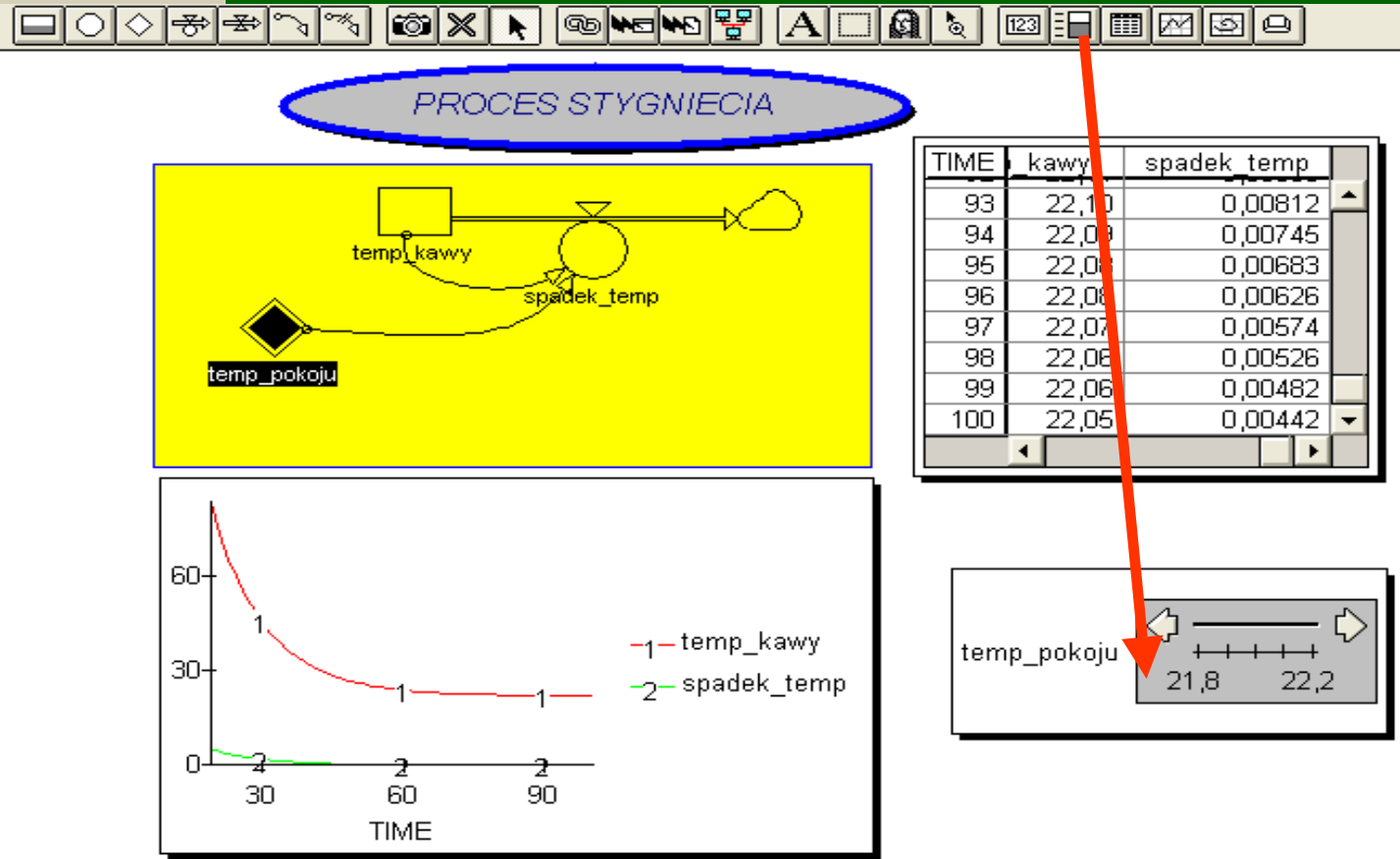
Interaktywne symulacje





Interaktywne zmiany parametrów

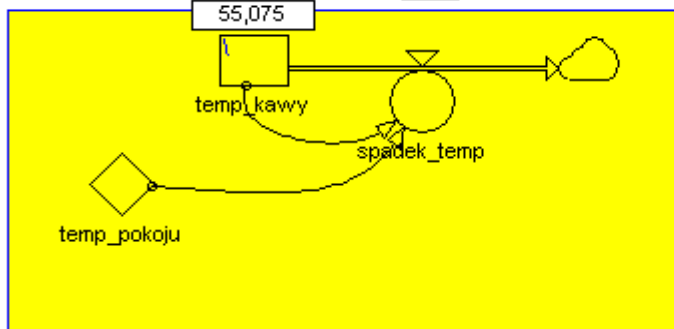
Zmiany parametrów



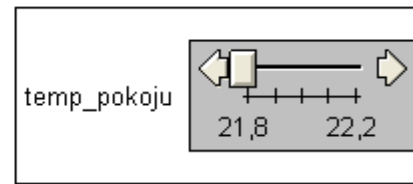
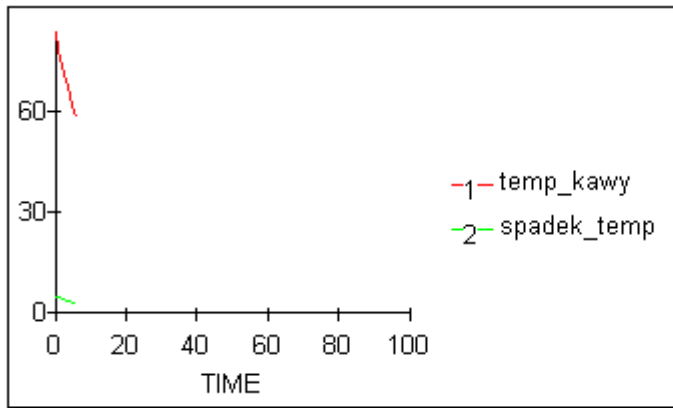
Zmiany parametrów



PROCES STYGNIECIA

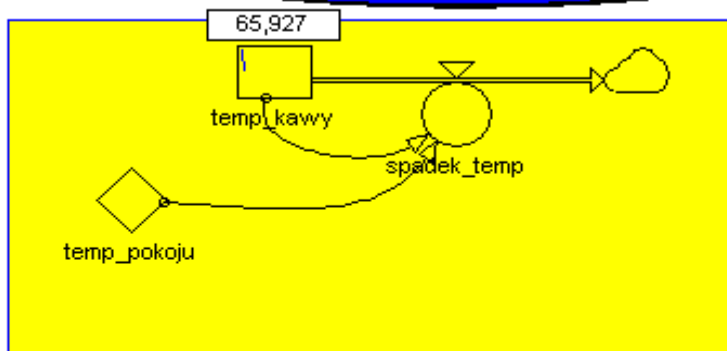


TIME	kawy	spadek temp
0	83,00	5,10
1	77,90	4,68
2	73,22	4,29
3	68,93	3,93
4	65,01	3,60
5	61,40	3,30
6	58,10	3,03
7	55,07	2,77

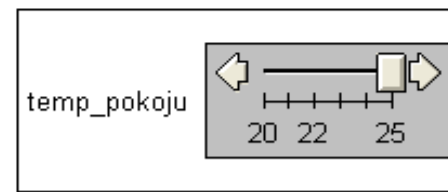
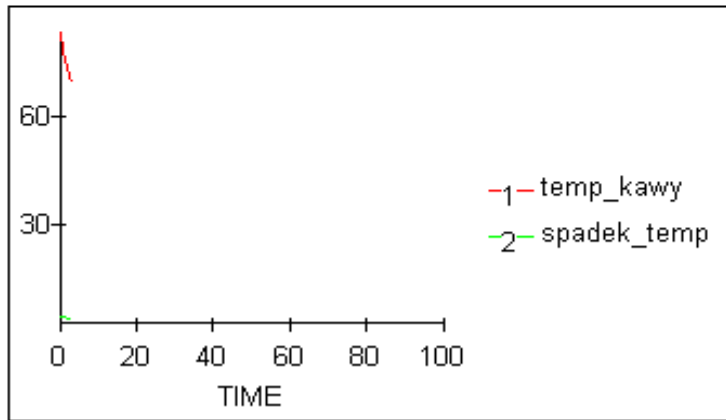


Zmiany parametrów

PROCES STYGNIECIA



TIME	kawvy	spadek temp
0	83,00	4,84
1	78,16	4,44
2	73,72	4,07
3	69,66	3,73
4	65,93	3,42



Zmiany parametrów

The screenshot shows a software interface with a toolbar at the top and a main window titled "PROCES STYGNIECIA". The main window contains a diagram with variables "temp_kawy" and "temp_pokoju", and a graph showing a temperature curve over time. A "Define Slider/Bar" dialog box is open, showing the "Bar Axis And Scale" configuration. The dialog box has the following sections:

- Models:** Main
- Variables:** temp_kawy, temp_pokoju
- Tick Marks:** Major: +, Minor: |
- Tick Labels:** Position: Bottom, Font..., Layout...
- Scale:** Auto, Minimum: 20,00, Maximum: 25,00, Minor unit: 0,10, Major unit: 1,00
- Bar:** Label Position: Left, Orientation: Horizontal, Label..., Bar Area..., Axis..., Fill With...
- Number:** Alignment: Center, Field Width: 10, Font..., Number Area..., Present, Limit Input

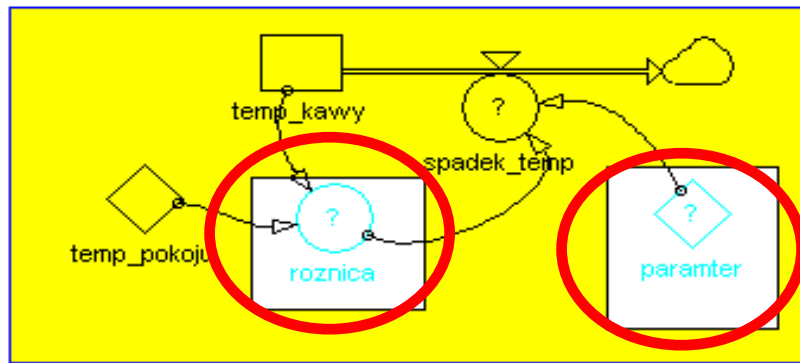
Buttons: OK, Cancel, Label..., Line..., Add ->, <- Remove, Pause, Keep Value.



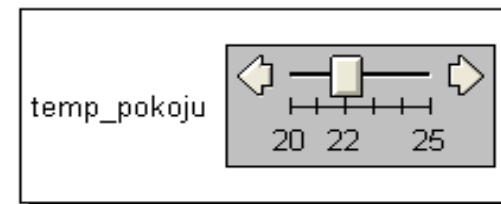
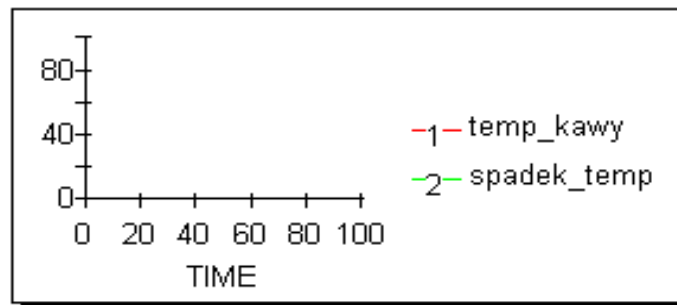
Modyfikacja modelu....?

Propozycje zmian...





PROCES STYGNIECIA



TIME	kawy	spadek temp
93	22,02	0,00156
94	22,02	0,00143
95	22,02	0,00131
96	22,01	0,0012
97	22,01	0,0011
98	22,01	0,00101
99	22,01	0,000923
100	22,01	0,000846



Propozycje zmian...

- temp_kawy
 - INIT** 83
 -  -dt*spadek_temp
 -  początkowa temperatura kawy w stopniach Celsiusza
- spadek_temp
 - =** (temp_kawy-temp_pokoju)/12
 -  Różnica temperatur: kawa-otoczenie
- roznica
 - =**
- paramter
 - =**
- temp_pokoju
 - =** 22
 -  temperatura otoczenia w stopniach Celsiusza



Propozycje zmian...

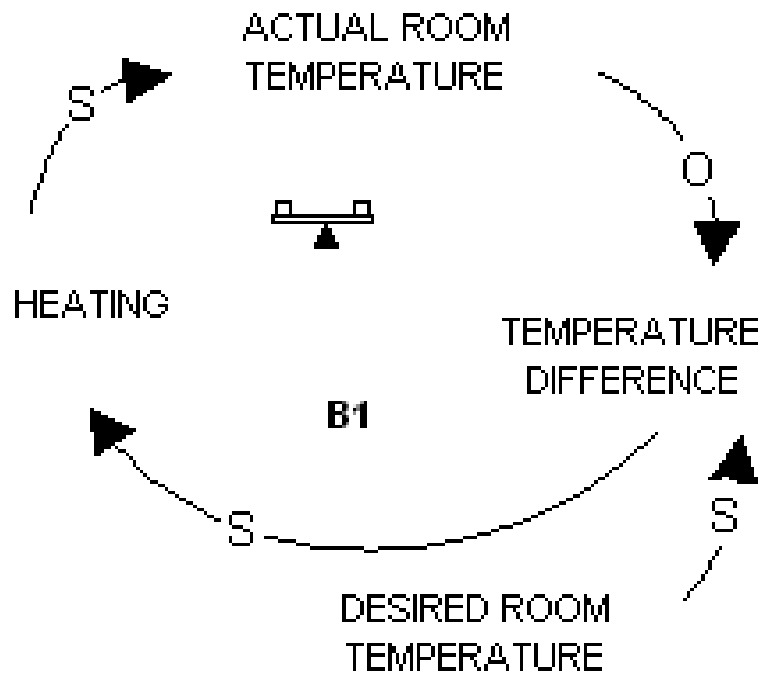
C. d. n.

...jako zadanie domowe...



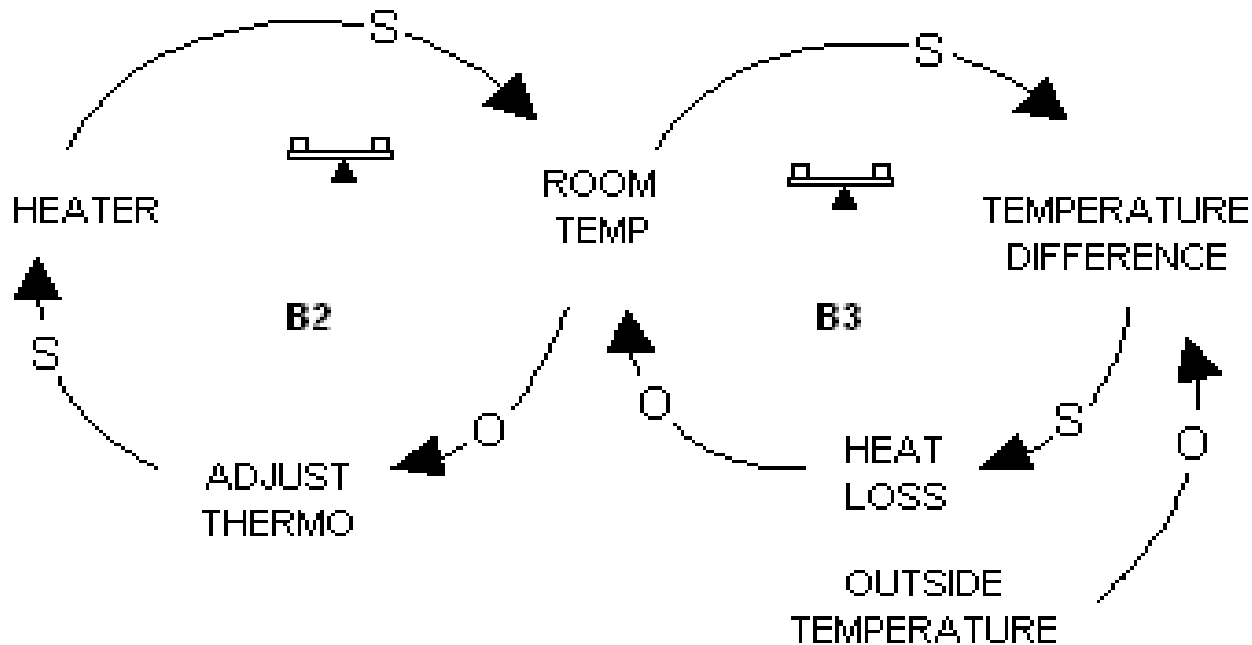
Modyfikacja - przykład rozszerzony: model z termoregulacją

Model z regulacją temperatury



Pętla podstawowa

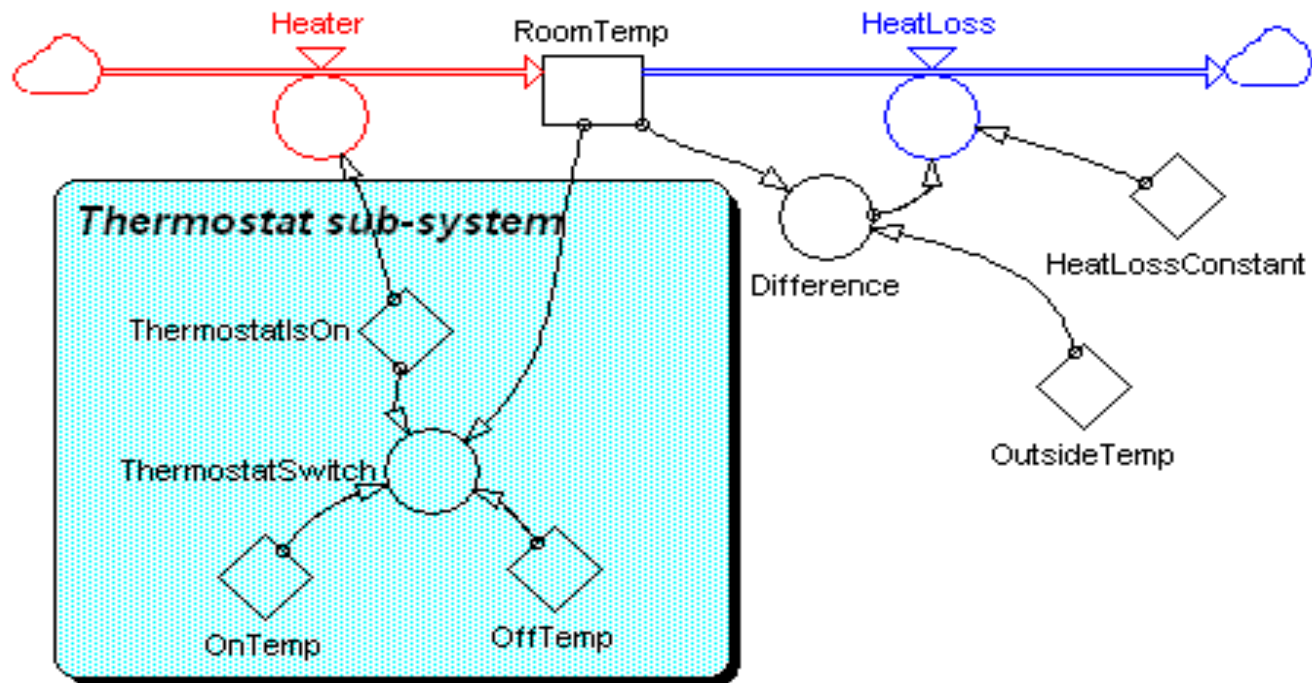
Model z regulacją temperatury



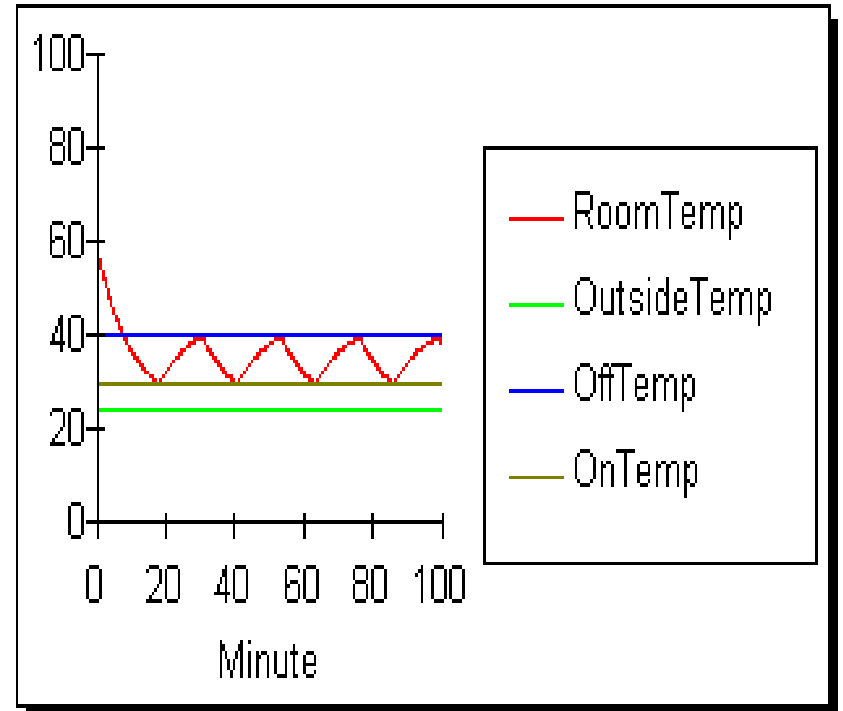
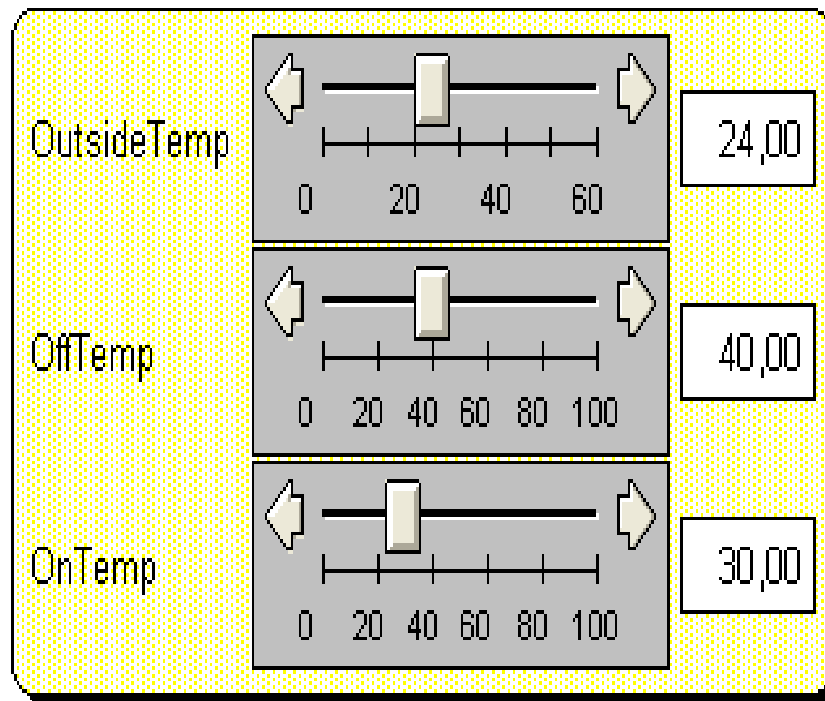
Pętla z termostatem

Model z regulacją temperatury

Flow Diagram of the Temperature Control System



Model z regulacją temperatury



Model z regulacją temperatury

□ RoomTemp = 60 {Celsius} +dt*Heater -dt*HeatLoss
 ▣ Celsius

○→ Heater = IF(ThermostatIsOn, 2, 0)
 ▣ Celsius/Minute

○→ HeatLoss = Difference*HeatLossConstant
 ▣ Celsius/Minute

○ Difference = RoomTemp-OutsideTemp
 ▣ Celsius

○ ThermostatSwitch = IF(ThermostatIsOn,
 "THEN" ASSIGN(ThermostatIsOn, RoomTemp<OffTemp),
 "ELSE" ASSIGN(ThermostatIsOn, RoomTemp<OnTemp))
 ▣ Condition

◇ HeatLossConstant = 0.1

◇ OffTemp = 40 {Celsius}
 ▣ Celsius

◇ OnTemp = 30 {Celsius}
 ▣ Celsius

◇ OutsideTemp = 24 {Celsius}
 ▣ Celsius

◇ ThermostatIsOn = 0 {Condition}
 ▣ Condition