physibel

BISCO v13 New program performances

BISCO v13

BISCO v13 – Overview

A Implementation of NFRC 100/500

Both NFRC 100* and NFRC 500** have an option to report thermal transmittance and condensation risk based on 2D numerical simulation. The overlying methodology to model heat transfer at boundaries and within frame cavities in the NFRC standards is adopted from ISO 15099***.

*ANSI/NFRC 100 (2023): Procedure for Determining Fenestration Product U-factors
**ANSI/NFRC 500 (2023): Procedure for Determining Fenestration Product Condensation Index Ratings
*** ISO 15099 (2003): Thermal performance of Window, Doors, Shading Devices – Detailed calculations

BISCO v13 includes new functions to calculate and report frame thermal transmittance and Condensation Index Rating according to NFRC 100/500

A.1 Implementation of underlying ISO 15099

overview

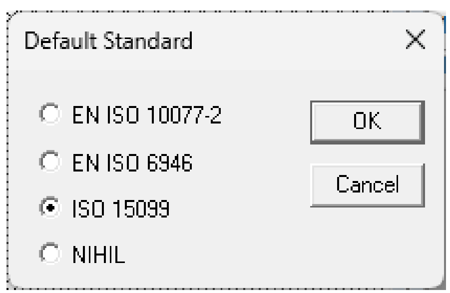
Air cavities in ISO 15099 can be modelled with either:

- Single equivalent thermal conductivity method: EQUIMAT
- Radiosity method (detailed radiation): TRANSMAT

Colours

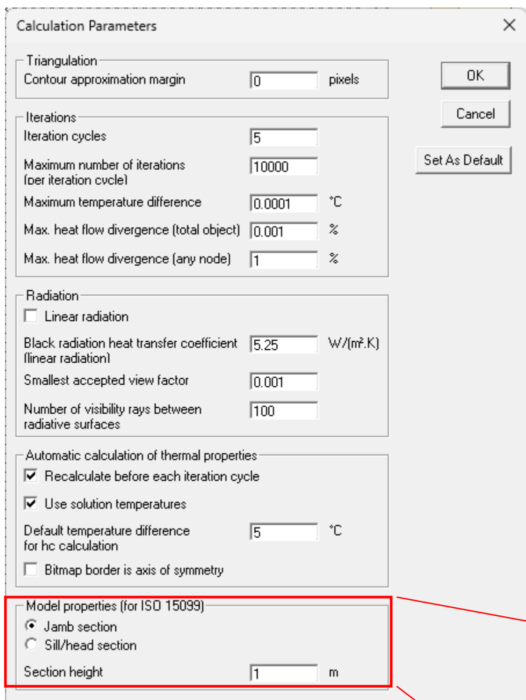
Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [- / -]	λ [W/mK]	ε [-]	Standard
195		EQUIMAT	CAVITY	HOR	X		0.90 / 0.90	0.040	0.90	ISO15099
196		TRANSMAT	CAVITY	HOR	X			0.024		ISO15099

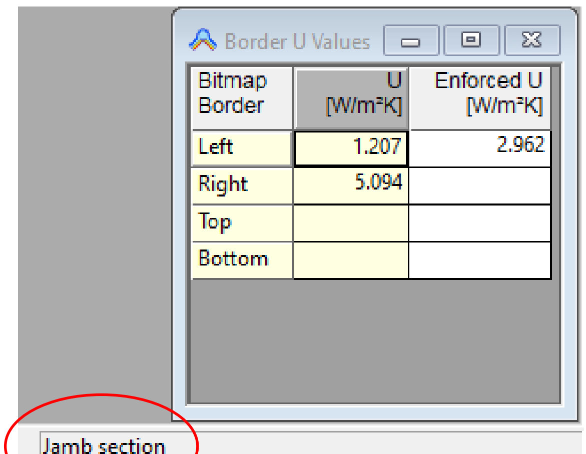
ISO 15099 can be set as default standard: Settings → Default Standard



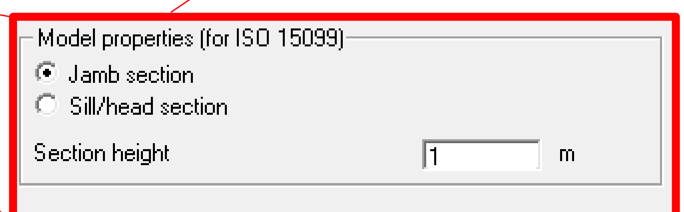
A.1 Implementation of underlying ISO 15099

For the calculation of convective heat transfer in frame cavities ISO 15099 differentiates between sill/head and jamb.
→ General setting in Calculation Parameters





Setting indicated in status bar



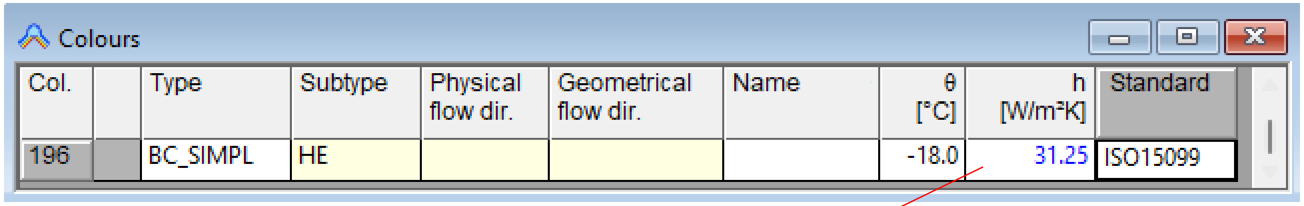
A.1 Implementation of underlying ISO 15099

According to ISO 15099 boundary conditions can be used with simplified or with detailed radiation (view factor method). Both options are available:

- Simplified infrared radiation: BC_SIMPL
- Detailed infrared radiation: BC_SKY

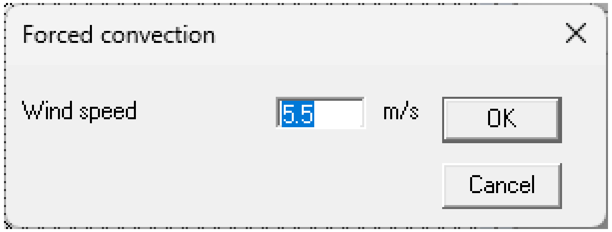
BC_SIMPL (global surface coefficient)

Physical flow direction can be set to horizontal, upwards, downwards or any



Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	θ [°C]	h [W/m²K]	Standard
196		BC_SIMPL	HE				-18.0	31.25	ISO15099

Double click to set wind speed



A.1 Implementation of underlying ISO 15099

According to ISO 15099 boundary conditions can be used with simplified or with detailed radiation (view factor method). Both options are available:

- Simplified infrared radiation: BC_SIMPL
- Detailed infrared radiation: BC_SKY

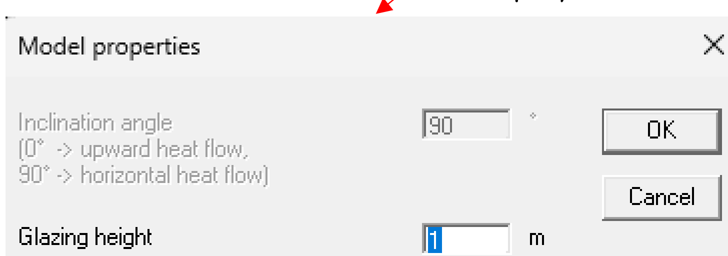
BC_SKY (view factor based)

Physical flow direction can be set to horizontal, upwards, downwards or any

Colours

Col.		Type	Subtype	Physical flow dir.	Name	q [W/m²]	θa [°C]	hc [W/m²K]	θr [°C]	Standard
196		BC_SKY	CONVEC	HOR		0	21.0	2.18	21.0	ISO15099

Double click to set Glazing height and inclination (when physical flow direction is ANY)



A.2 Boundary conditions according to NFRC 100/500

overview

Boundary conditions prescribed by NFRC 100/500:

- Interior conditions:
  - Radiation model = "Automatic Enclosure Model" → BC_SKY
  - Frame: Standard to NIHIL, manual input of hc (convective film coefficient)

Colours

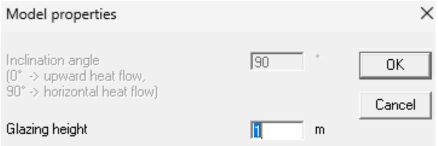
Col.		Type	Subtype	Name	θa [°C]	hc [W/m²K]	θr [°C]	Standard
169		BC_SKY	NIHIL	Interior Wood/Vinyl Frame	21.0	2.44	21.0	NIHIL

  - Edge and Centre of Glass: Standard to ISO15099

Colours

Col.		Type	Subtype	Physical flow dir.	Name	θa [°C]	hc [W/m²K]	θr [°C]	Standard
167		BC_SKY	CONVEC	HOR	Interior - centre of glass	21.0	2.18	21.0	ISO15099

Double click to adjust glazing height



- Exterior conditions
  - Radiation model = "Blackbody Model" → BC_SIMPL
  - Default colour in Colour Database (colour 171)

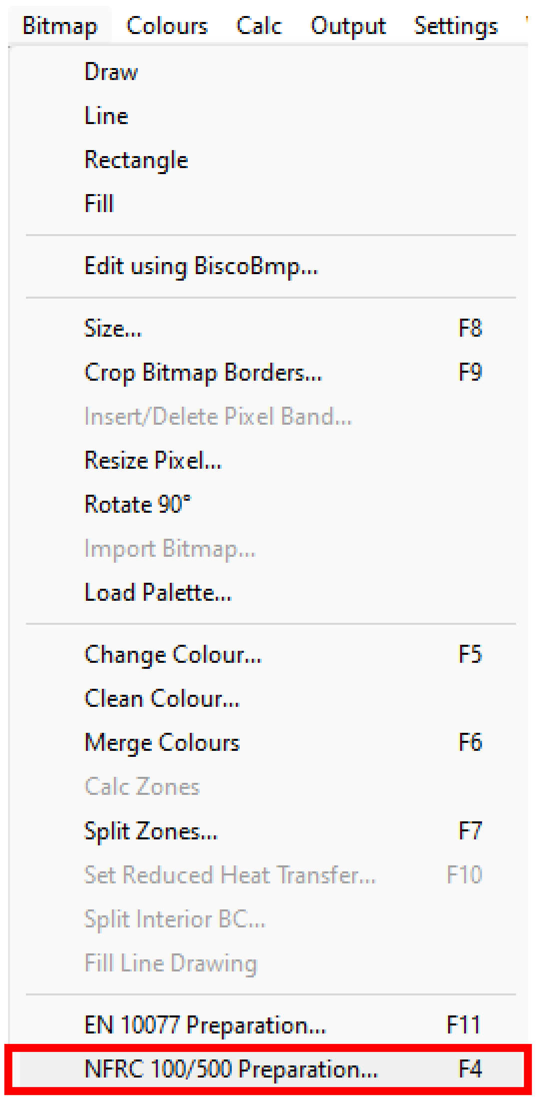
Colours

Col.		Type	Subtype	Name	θ [°C]	h [W/m²K]	Standard
171		BC_SIMPL	HE	exterior NFRC 100 (Blackbody)	-18.0	31.25	ISO15099

Windspeed can be adjusted by double clicking (default wind speed is 5.5 m/s)

A.3 Automatic preparation according to NFRC 100/500

overview



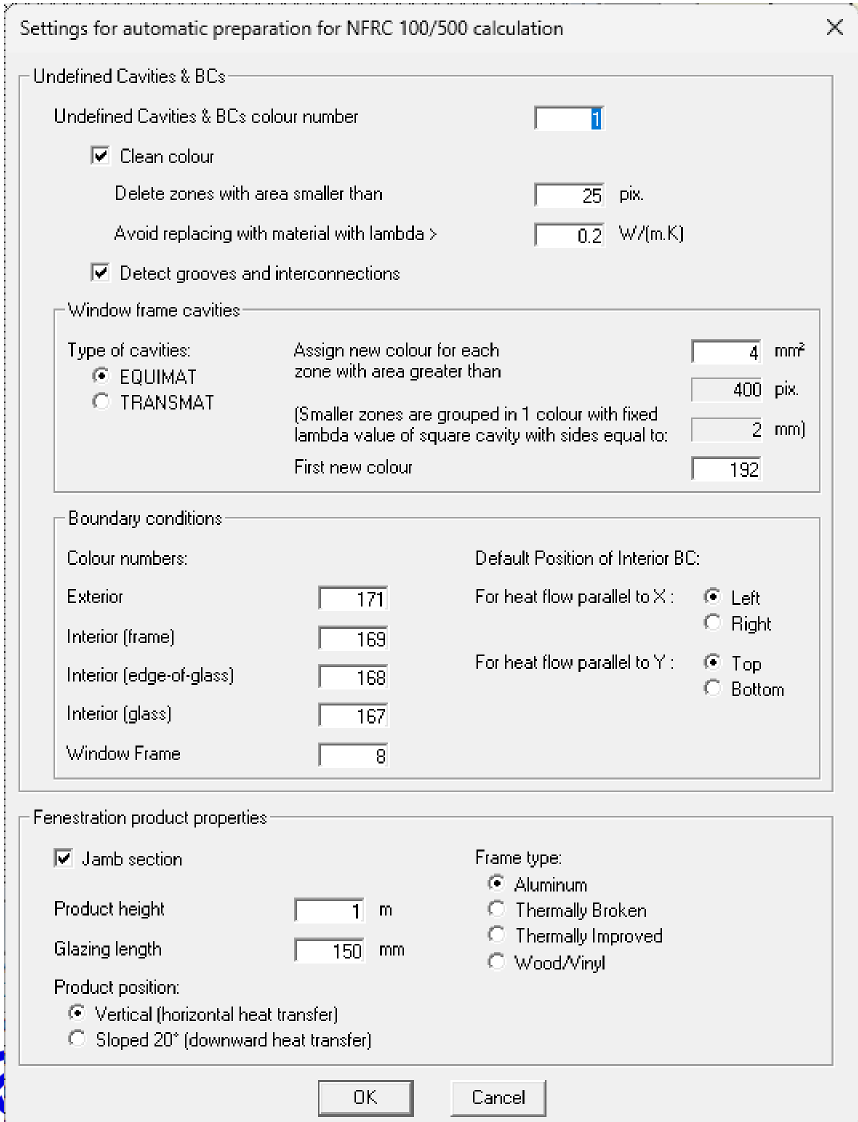
New function which prepares the geometry and report output according to NFRC 100/500:

- Defines boundary conditions (frame, edge of glass and centre of glass)
- Assigns properties to frame cavities according to ISO 15099
- Extends the length of glass to meet required 150mm
- Selects Derived thermal properties for reporting: Ufr and Ueg

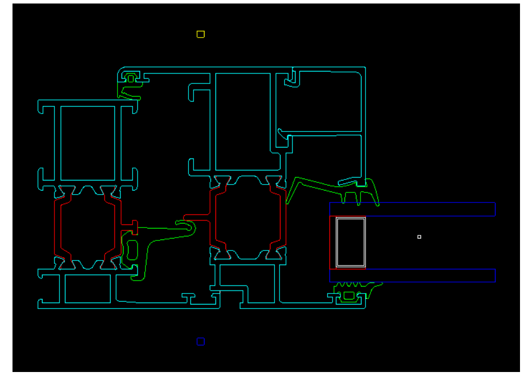
A.3 Automatic preparation according to NFRC 100/500

overview

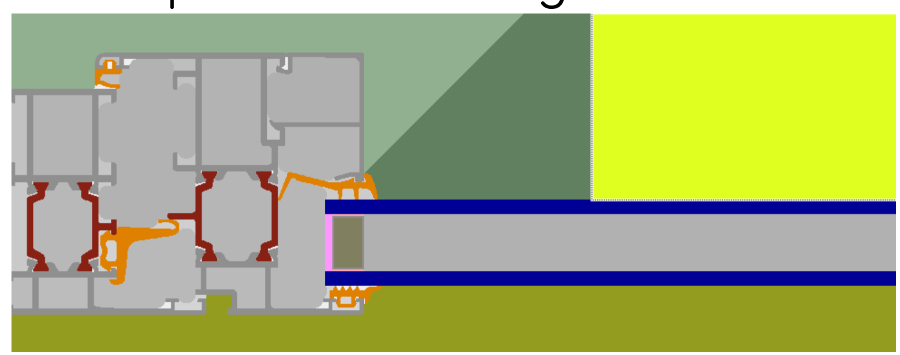
Settings → Settings for automatic preparation for NFRC 100/500 calculation



DXF format



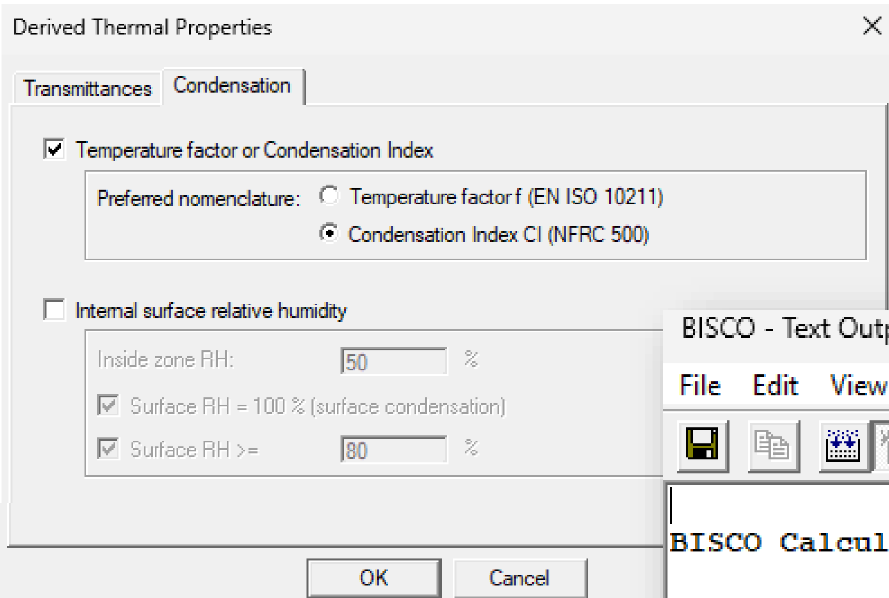
Prepared according to NFRC

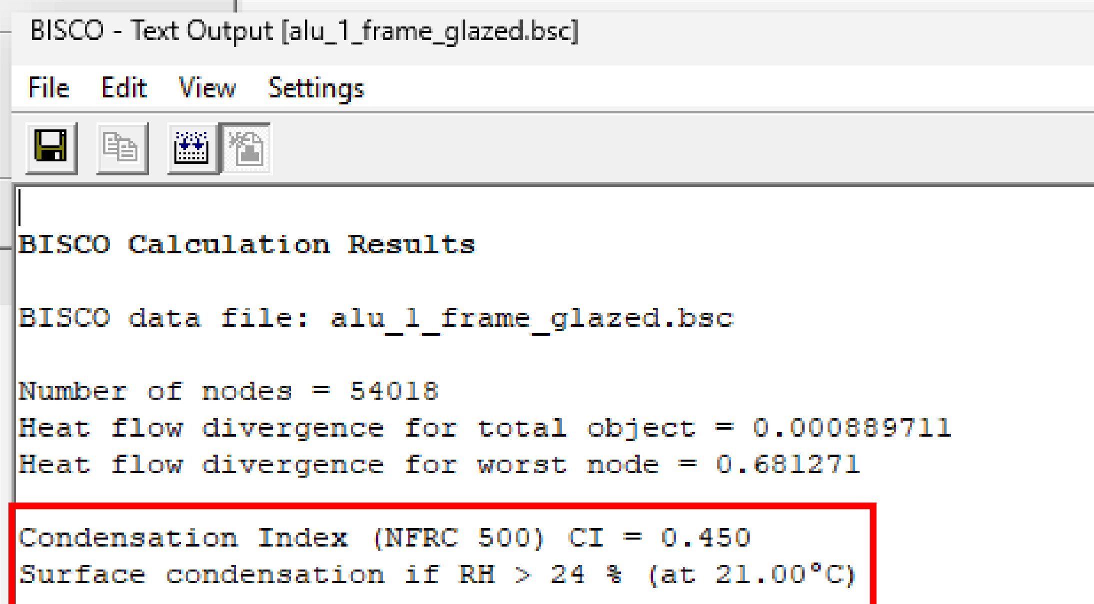


A.4 Output of Condensation index according to NFRC 500

overview

Edit → Derived thermal properties → Condensation → Condensation Index CI (NFRC 500)



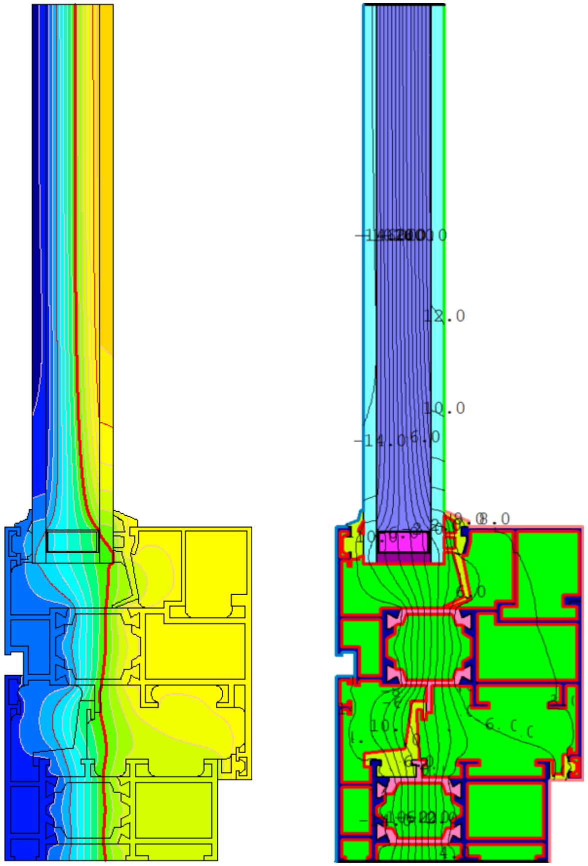


A.5 Validation report BISCO v13 vs. THERM 7.8

overview

Validation report available on the Physibel Knowledge Base:

"A14 - Validation of the program BISCO v13 according to NFRC 100 and ISO 15099:2003: BISCO vs. THERM"



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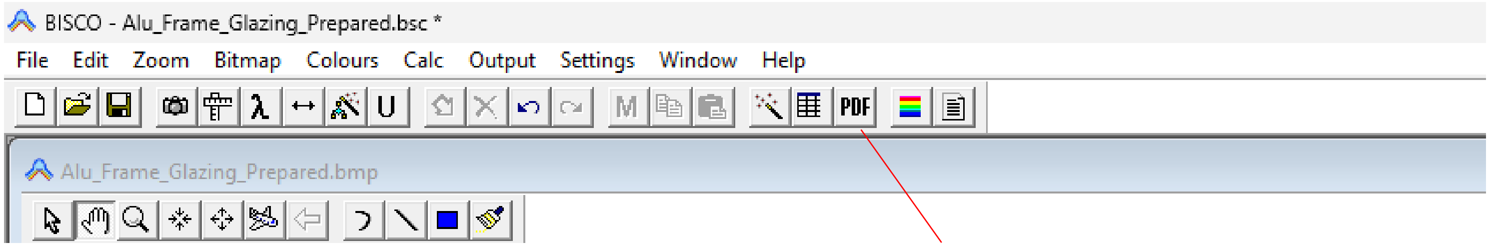
BISCO v13

B.1 New function ‘Make PDF report’

overview



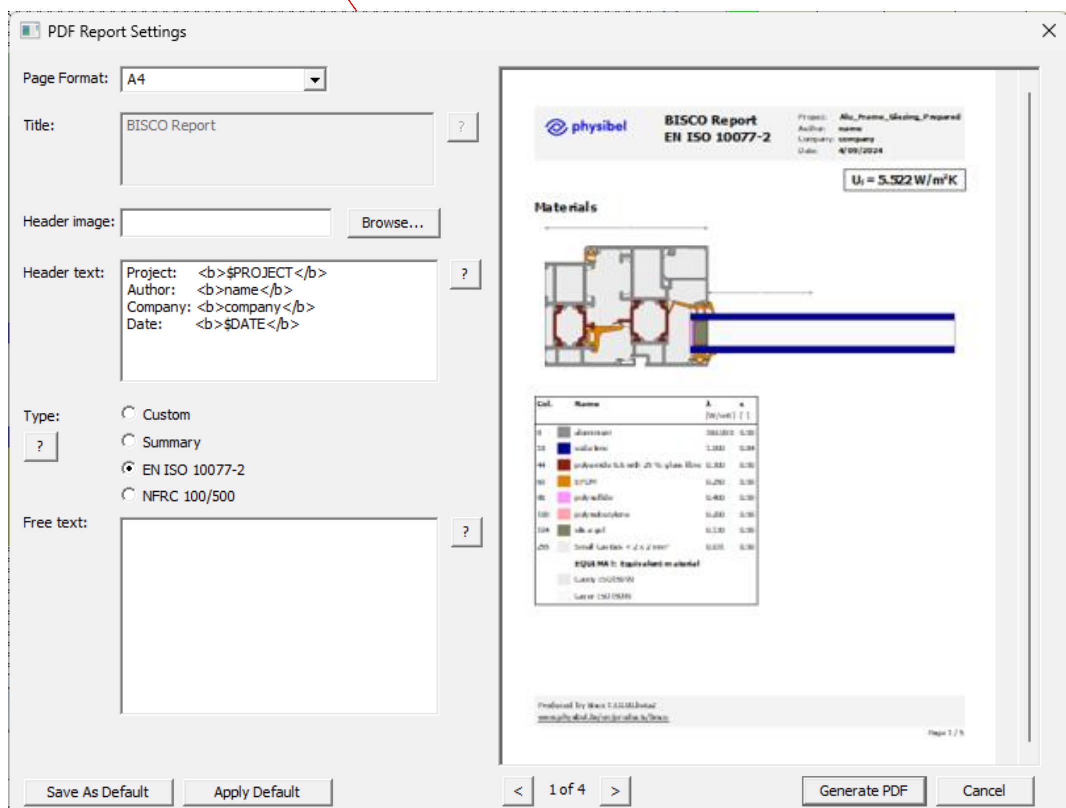
PDF report Settings: live PDF preview

Add company logo

customize header text

Choose report type

Store settings



B.1 Type: Custom report

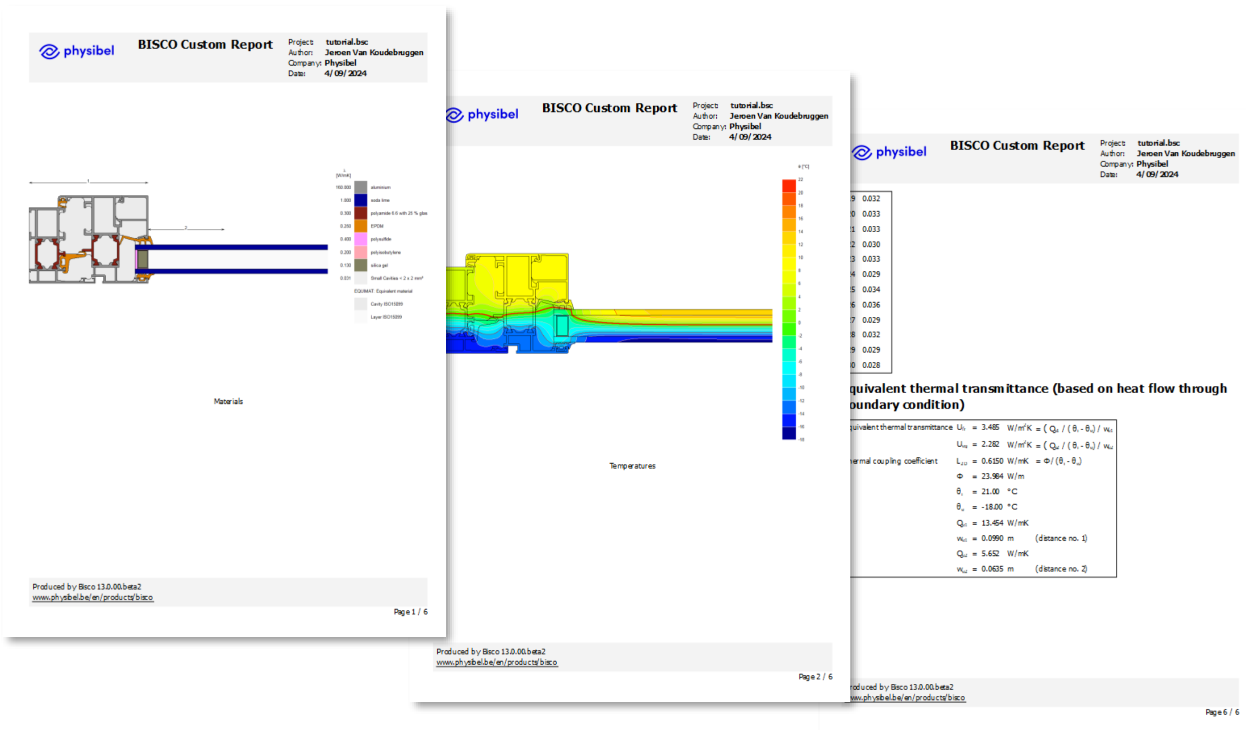
Custom report includes:

- figures defined under 'Graphic Report Definitions'
- Text output defined under 'Derived thermal properties'

Graphic Report Definition

Image	Create	Object Lines	Triang. Mesh	Isoth. Lines	Flow Lines	Distances	Fill	Legend	Caption
1	YES	YES	NO	NO	NO	YES	MATERIAL	YES	Materials
2	YES	YES	NO	YES	NO	NO	TEMP	YES	Temperatures
3	YES	YES	NO	NO	YES	NO	OFF	NO	Heat flow

Figure caption used in pdf report



BISCO v13

B.1 Type: Summary report

Summary report:

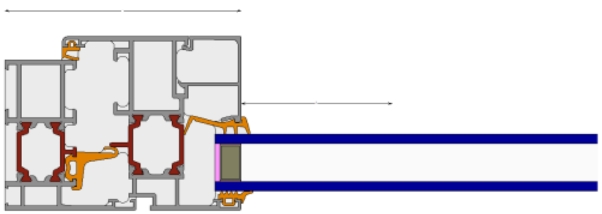
- Concise auto report (2 pages)
- 'Derived thermal properties' + 2 figures (materials and temperatures)

physibel **BISCO Report (summary)**

Project: tutorial.bsc
Author: Jeroen Van Koudebruggen
Company: Physibel
Date: 4/09/2024

$U_{eq1} = 3.485\ W/m^2K$ $U_{eq2} = 2.282\ W/m^2K$

Materials



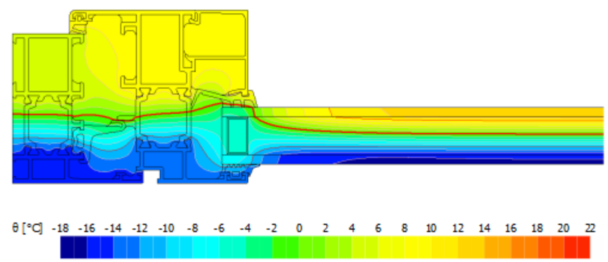
Col.		Name	λ [W/mK]	ε [-]
8		aluminium	160.000	0.90
18		soda lime	1.000	0.84
44		polyamide 6.6 with 25 % glass fibre	0.300	0.90
60		EPDM	0.250	0.90
86		polysulfide	0.400	0.90
100		polyisobutylene	0.200	0.90
104		silica gel	0.130	0.90
255		Small Cavities < 2 x 2 mm²	0.031	0.90
		EQUIMAT: Equivalent material		
		Cavity ISO15099		
		Layer ISO15099		

Temperatures

Produced by Bisco 13.0.00.beta2
www.physibel.be/en/products/bisco

physibel **BISCO Report (summary)**

Project: tutorial.bsc
Author: Jeroen Van Koudebruggen
Company: Physibel
Date: 4/09/2024



Equivalent thermal transmittance (based on heat flow through boundary condition)

Equivalent thermal transmittance	U_{fr}	= 3.485	W/m²K	$= (Q_{d1} / (\theta_i - \theta_e) / w_{d1}$
	U_{eq}	= 2.282	W/m²K	$= (Q_{d2} / (\theta_i - \theta_e) / w_{d2}$
Thermal coupling coefficient	L_{2D}	= 0.6150	W/mK	$= \Phi / (\theta_i - \theta_e)$
	Φ	= 23.984	W/m	
	θ_i	= 21.00	°C	
	θ_e	= -18.00	°C	
	Q_{d1}	= 13.454	W/mK	
	w_{d1}	= 0.0990	m	(distance no. 1)
	Q_{d2}	= 5.652	W/mK	
	w_{d2}	= 0.0635	m	(distance no. 2)

Produced by Bisco 13.0.00.beta2
www.physibel.be/en/products/bisco

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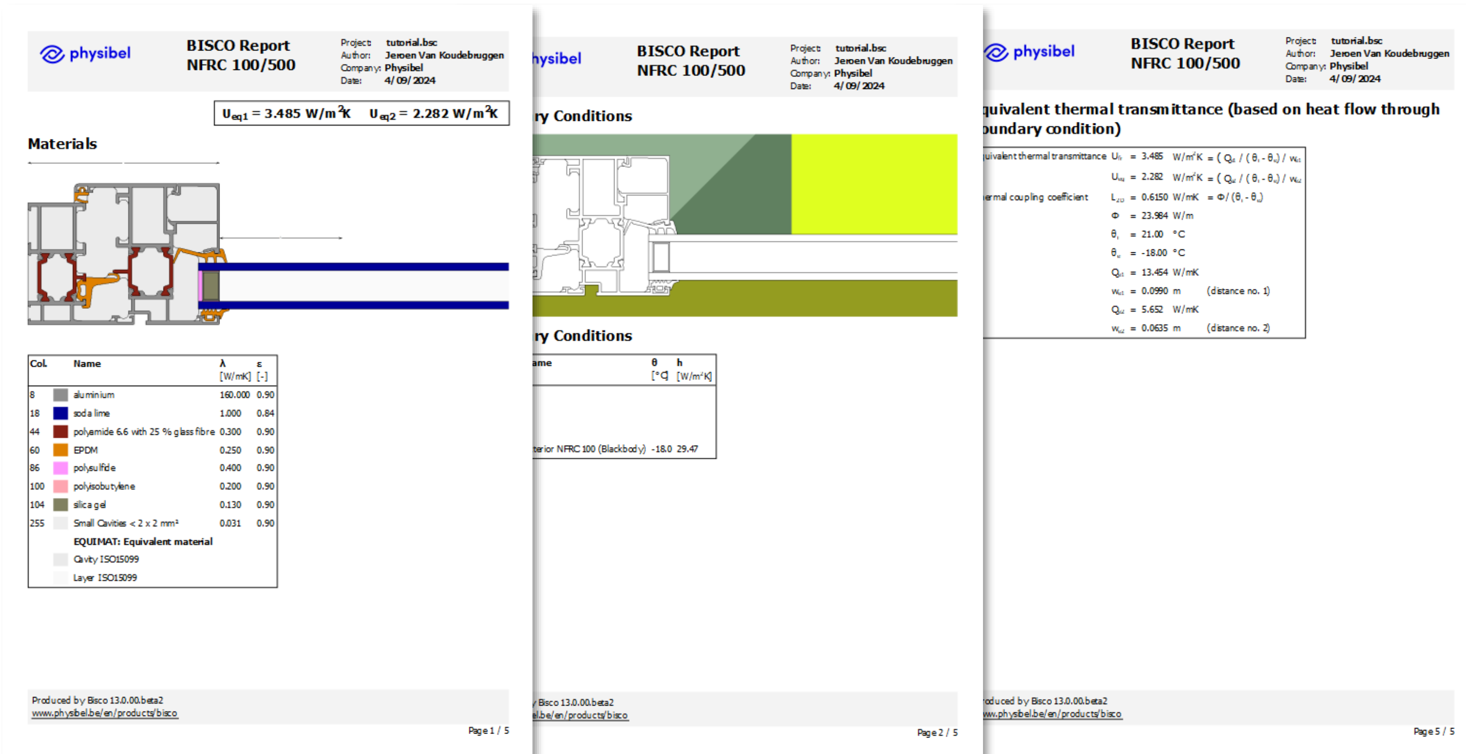
BISCO v13

B.1 Type: Standard report (EN 10077-2, NFRC 100/500)

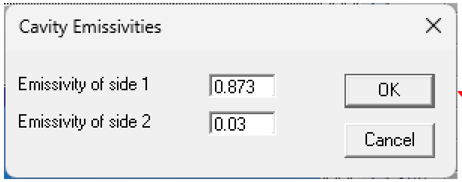
Standard report according to EN 10077-2 or NFRC 100/500:

- Includes information as requested by corresponding standard



C.1 Gas mix according to EN ISO 673

overview

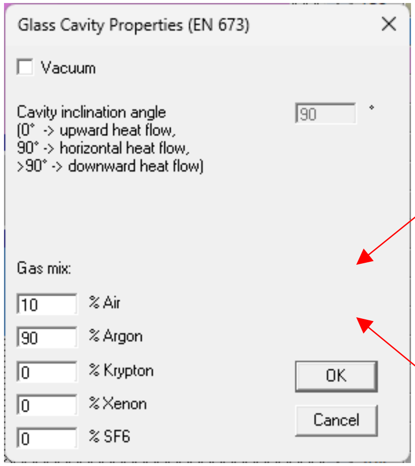


Double click to assign adjacent surface emissivity's

Colours

Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [- / -]	λ [W/mK]	Standard
17		EQUIMAT	LAYER	HOR	Y	90%Argon 10%Air	0.87 / 0.03	0.022	EN673

'Single equivalent thermal conductivity method'



Double click to assign gas mix

Colours

Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [- / -]	λ [W/mK]	Standard
17		TRANSMAT	LAYER	HOR	Y	90%Argon 10%Air		0.019	EN673

'Radiosity method'

physibel

BISCO v13

C.2 Gas mix according to ISO 15099

overview

Cavity Emissivities

Emissivity of side 1: 0.873
Emissivity of side 2: 0.03

OK | Cancel

Double click to assign adjacent surface emissivity's

Colours

Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [-/-]	λ [W/mK]	ε [-]	Standard
17		EQUIMAT	LAYER	HOR	Y	90%Argon 10%Air	0.87 / 0.03	0.032		ISO15099

'Single equivalent thermal conductivity method'

Indicate a gas filling as a Subtype 'LAYER'

Glass Cavity Properties (ISO 15099)

Vacuum

Cavity inclination angle (0° -> upward heat flow, 90° -> horizontal heat flow, >90° -> downward heat flow): 90 °

Glazing height (For inclination angle >= 60° and < 90°): 1 m

Gas mix:

- 10 % Air
- 90 % Argon
- 0 % Krypton
- 0 % Xenon
- 0 % SF6

OK | Cancel

Double click to assign gas filling

Colours

Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [-/-]	λ [W/mK]	ε [-]	Standard
17		TRANSMAT	LAYER	HOR	Y	90%Argon 10%Air		0.029		ISO15099

'Radiosity method'

physibel

BISCO v13

C.3 Air cavities according to ISO 15099

overview

Cavity Emissivities

Emissivity of side 1: 0.873

Emissivity of side 2: 0.03

OK | Cancel

Double click to assign adjacent surface emissivity's

Colours

Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [- / -]	λ [W/mK]	ε [-]	Standard
194		EQUIMAT	CAVITY	HOR	Y		0.90 / 0.90	0.118	0.90	EN10077

'Single equivalent thermal conductivity method'

Indicate frame cavity with Subtype 'CAVITY'

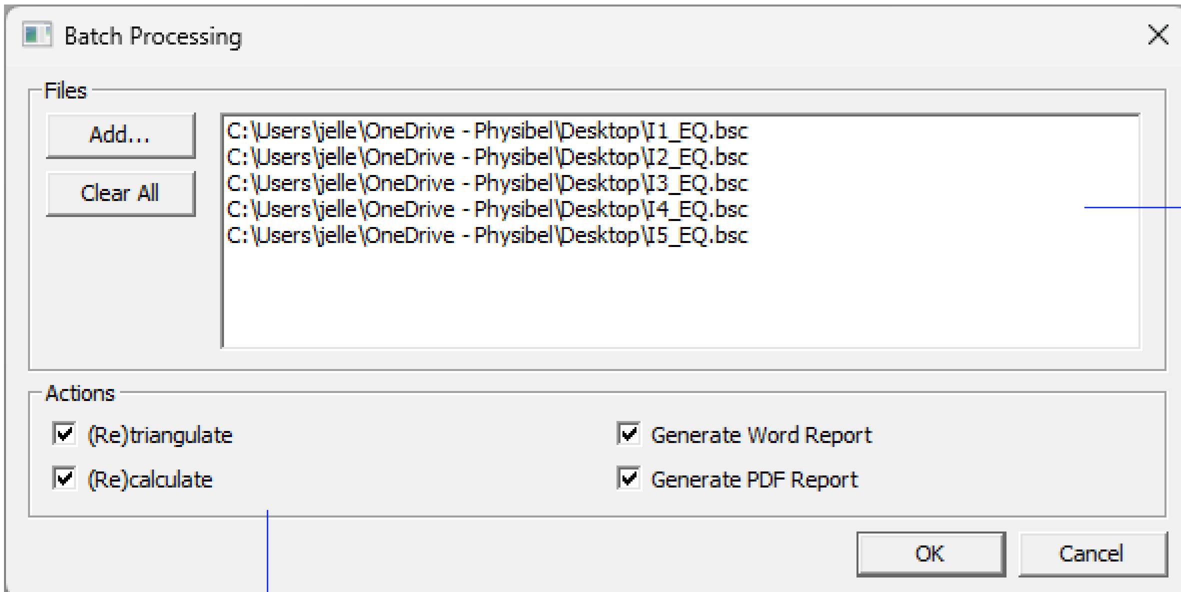
Colours

Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [- / -]	λ [W/mK]	ε [-]	Standard
194		TRANSMAT	CAVITY	HOR	X	air cavity ISO 15099		0.045		ISO15099

'Radiosity method'

D.1 New functions in Batch processing

(Re)run multiple BISCO projects

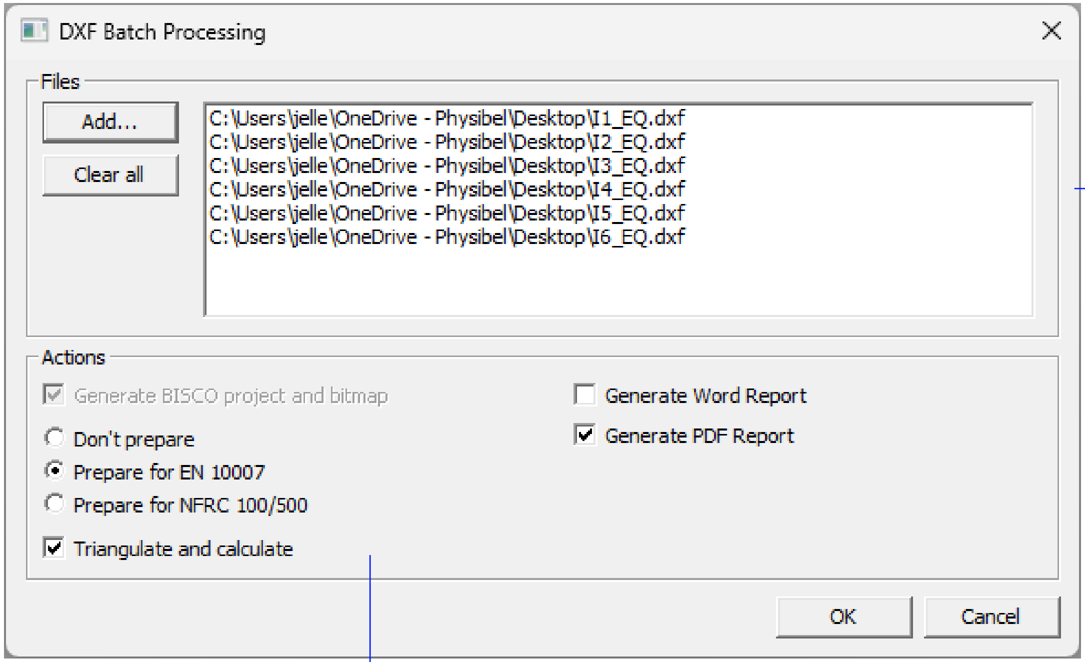


Selection of projects

Options:
- (Re)triangulate
- (Re)calculate
- Generate Word report
- Generate PDF report

D.2 New functions in DXF Batch processing

Multiple DXF files can be directly processed into a thermal report according to EN ISO 10077-2, NFRC or EN ISO 10211



Selection of DXF files

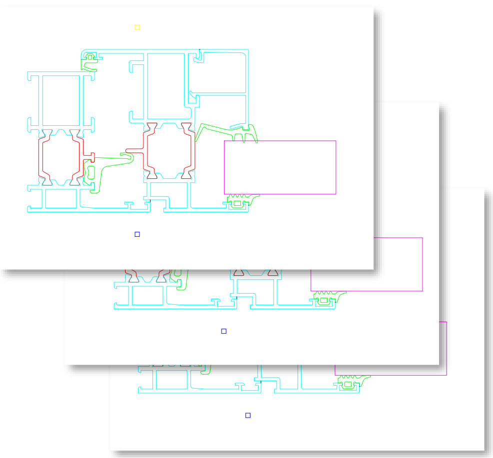
Options:

- Select standard, if preparation is desired (e.g. NFRC 100/500 or EN ISO 10077-2)
- Triangulate and calculate
- Generate Word report
- Generate PDF report

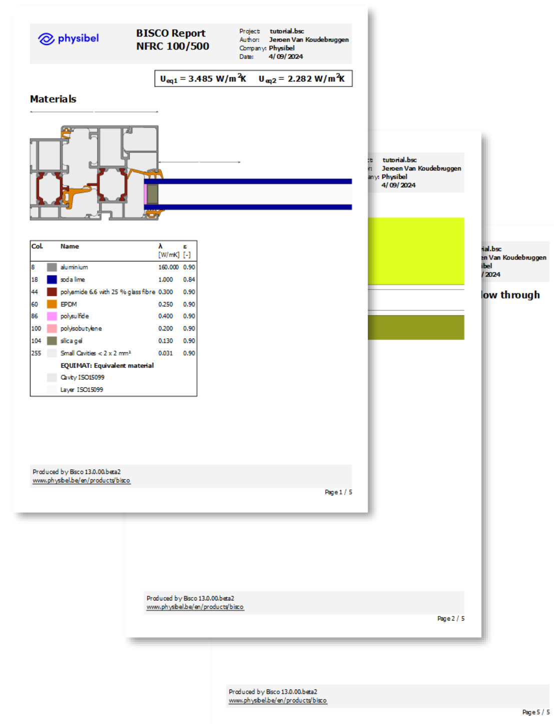
D.2 New functions in DXF Batch processing

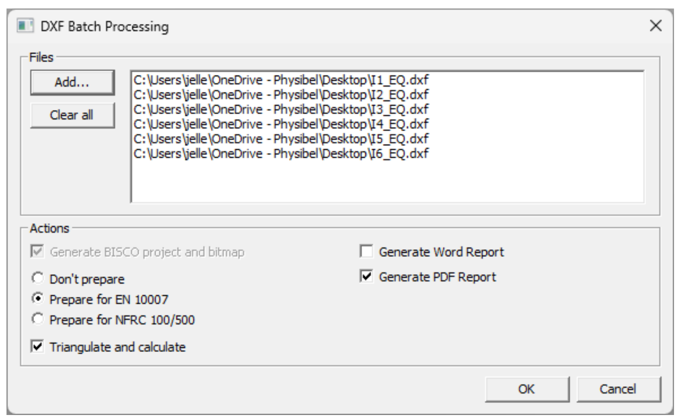
overview

Multiple DXF files



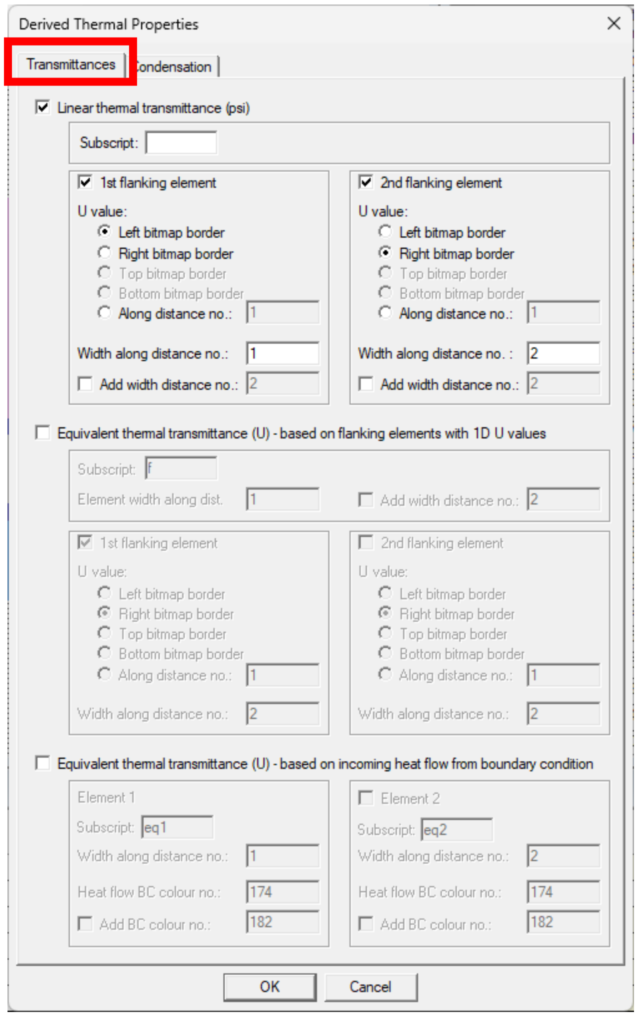
Thermal reports (pdf)

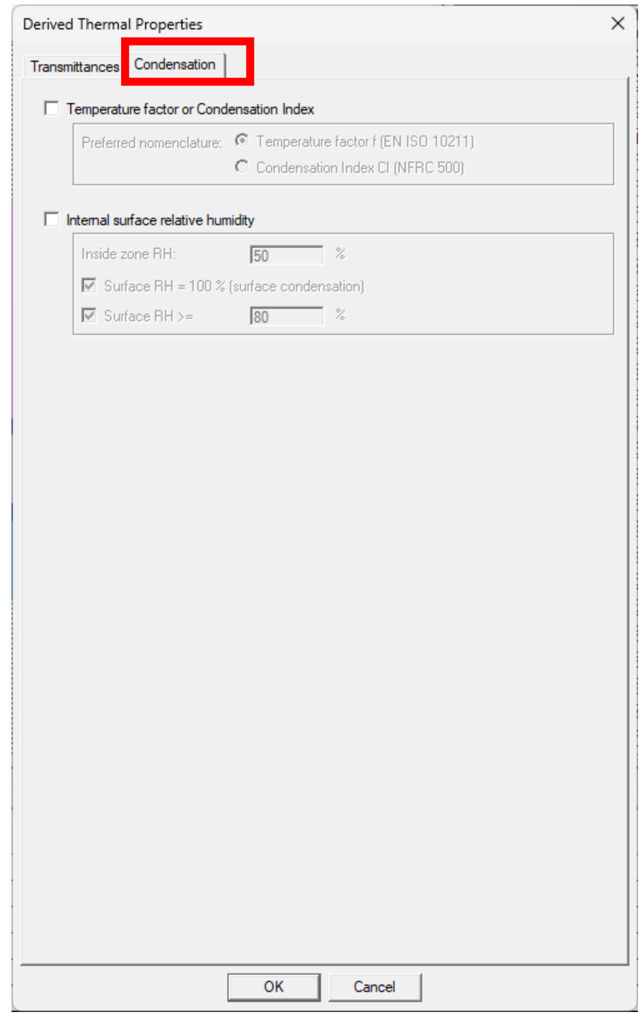




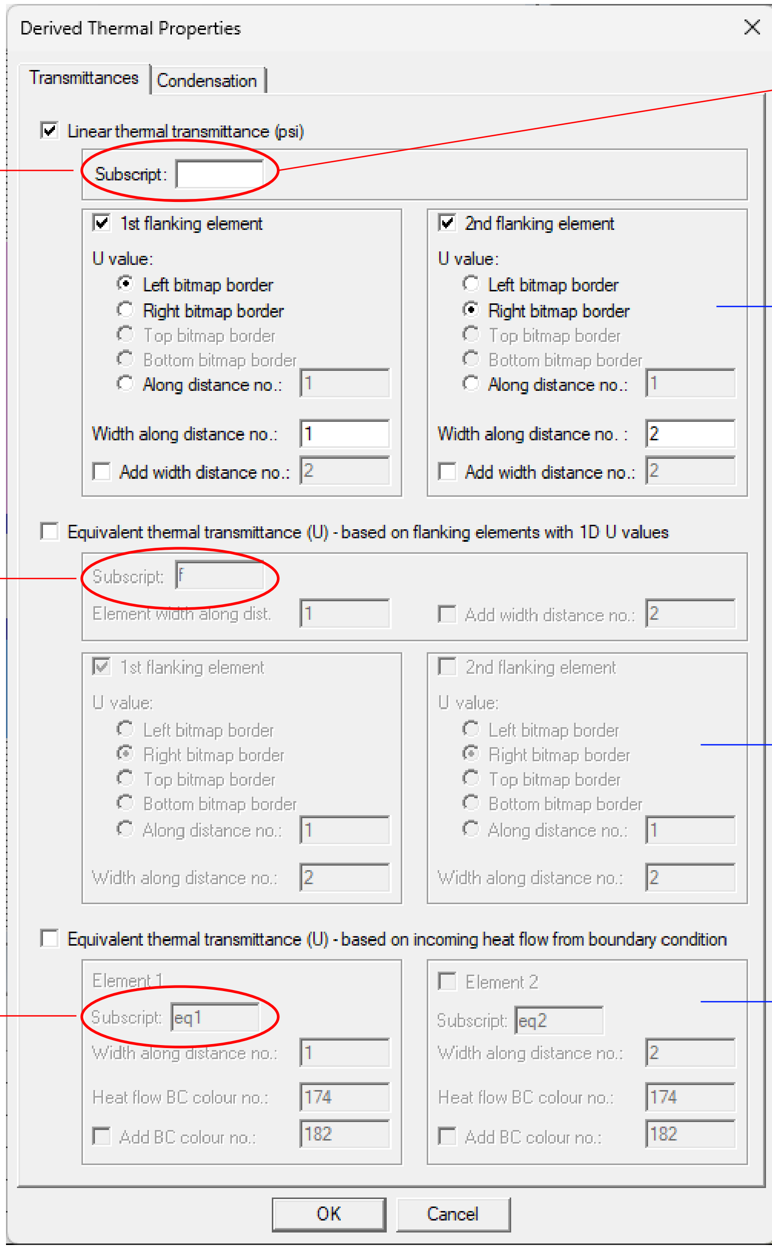
E.1 Dialog box split in ‘Transmittance’ and ‘Condensation’

overview





E.2 Derived Thermal Properties extended



Adjustable subscript
(e.g. Ψ_{tj}, U_{tj}, U_{eg}, U_f,...)

Ψ : linear thermal transmittance

U : equivalent thermal transmittance based on flanking elements with 1D U-value
(e.g. EN ISO 10077-2, EN ISO 12631)

U : equivalent thermal transmittance based on incoming heat flow from boundary condition
(e.g. NFRC 100)

F.1 Command line program execution

New options in running BISCO via command line

BISCO can be run from the command line prompt with a data file path (including directory and file extension .bsc) as parameter.

The switch "/Automation" can be added to the command line prompt determining which actions need to be taken after opening the .bsc data file, analogous to the choices offered in the Batch Processing dialog box (D.7):

- Either "/EN10077" or "/NFRC" for preparation for EN ISO 10077-2 or NFRC 100/500, respectively.
- "/triangulate" to force triangulation.
- "/calculate" for the thermal calculation.
- "/word", "/pdf" and/or "/pdf_summary" for the different types of reports.

Command Prompt

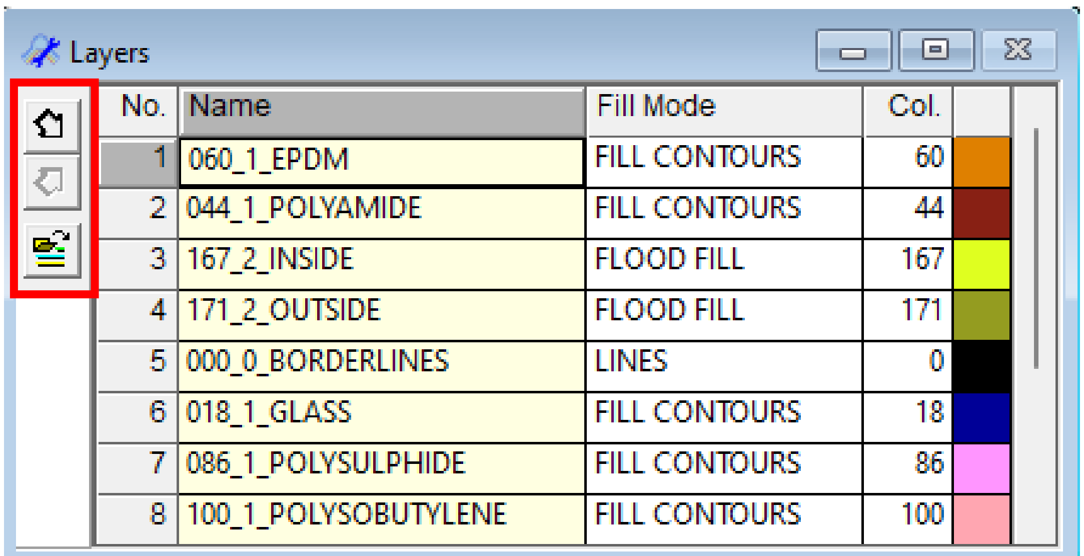
```
Microsoft Windows [Version 10.0.22631.4169]
(c) Microsoft Corporation. All rights reserved.

 "c:\…\Physibel\BISCO13\BISCO.exe" "…\Documents\Physibel\BISCO13\Demofiles\1 - WINDOWS &
 DOORS\shutter_box.bsc" /Automation /EN10077 /triangulate /calculate /pdf_summary
```

Adding only the switch "/Automation", prepares following: EN ISO 10077-2, triangulates, calculates and make MS WORD report files.

F.2 BiscoDxf: replaced icons for layer priortities

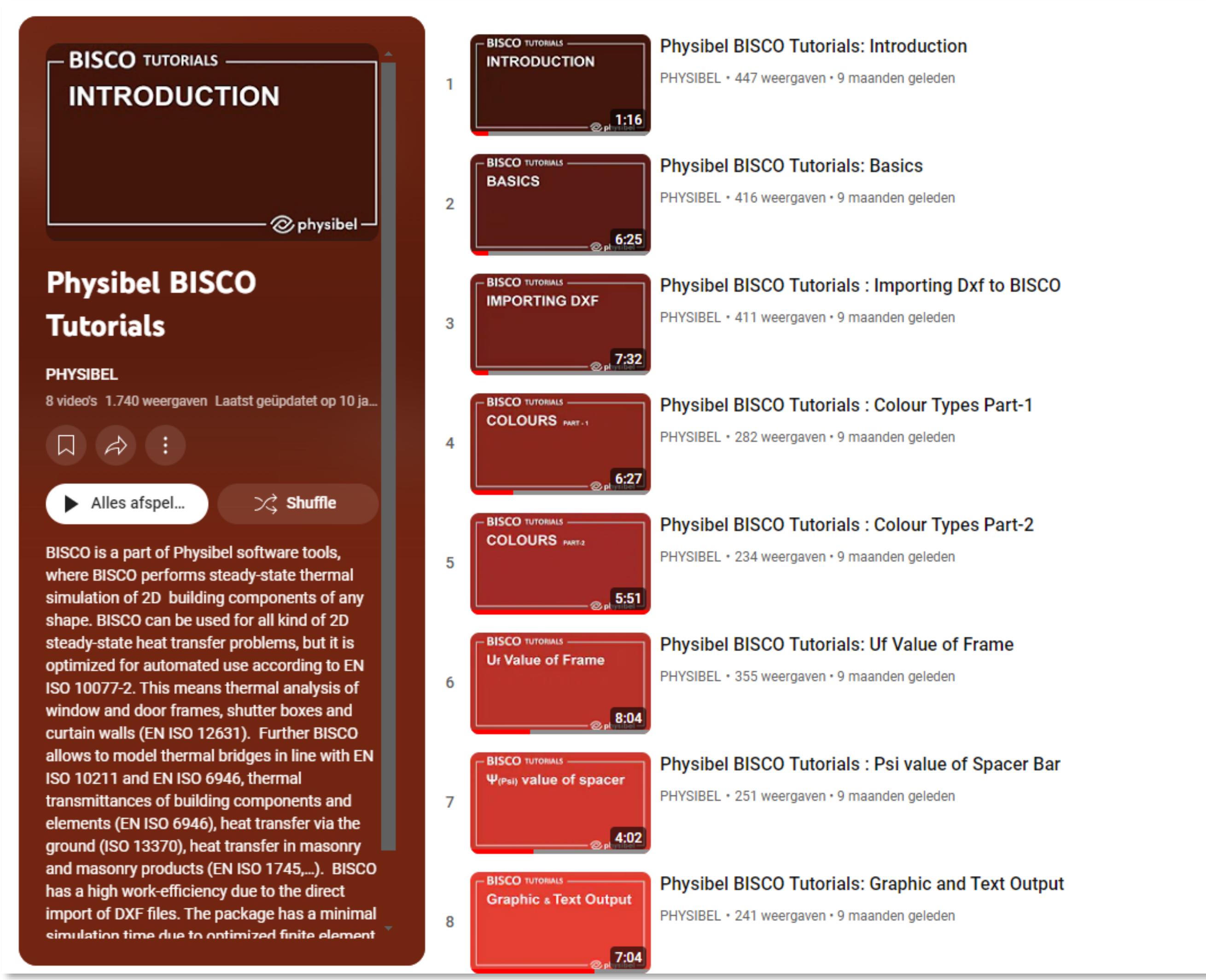
Icons for layer priority and loading layer definitions replaced



G.1 BISCO Youtube Channel with tutorials

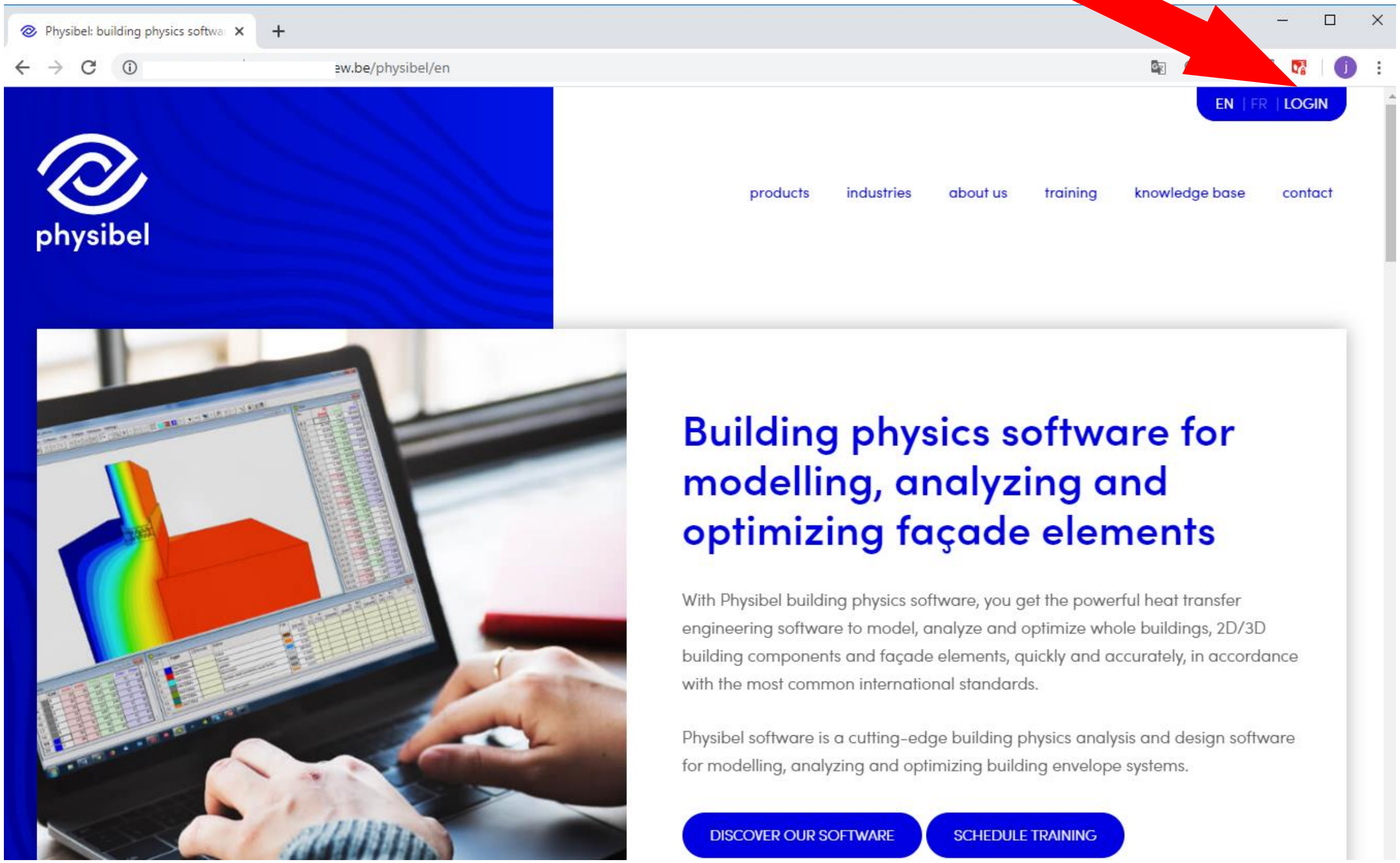
overview

Link to BISCO Youtube channel



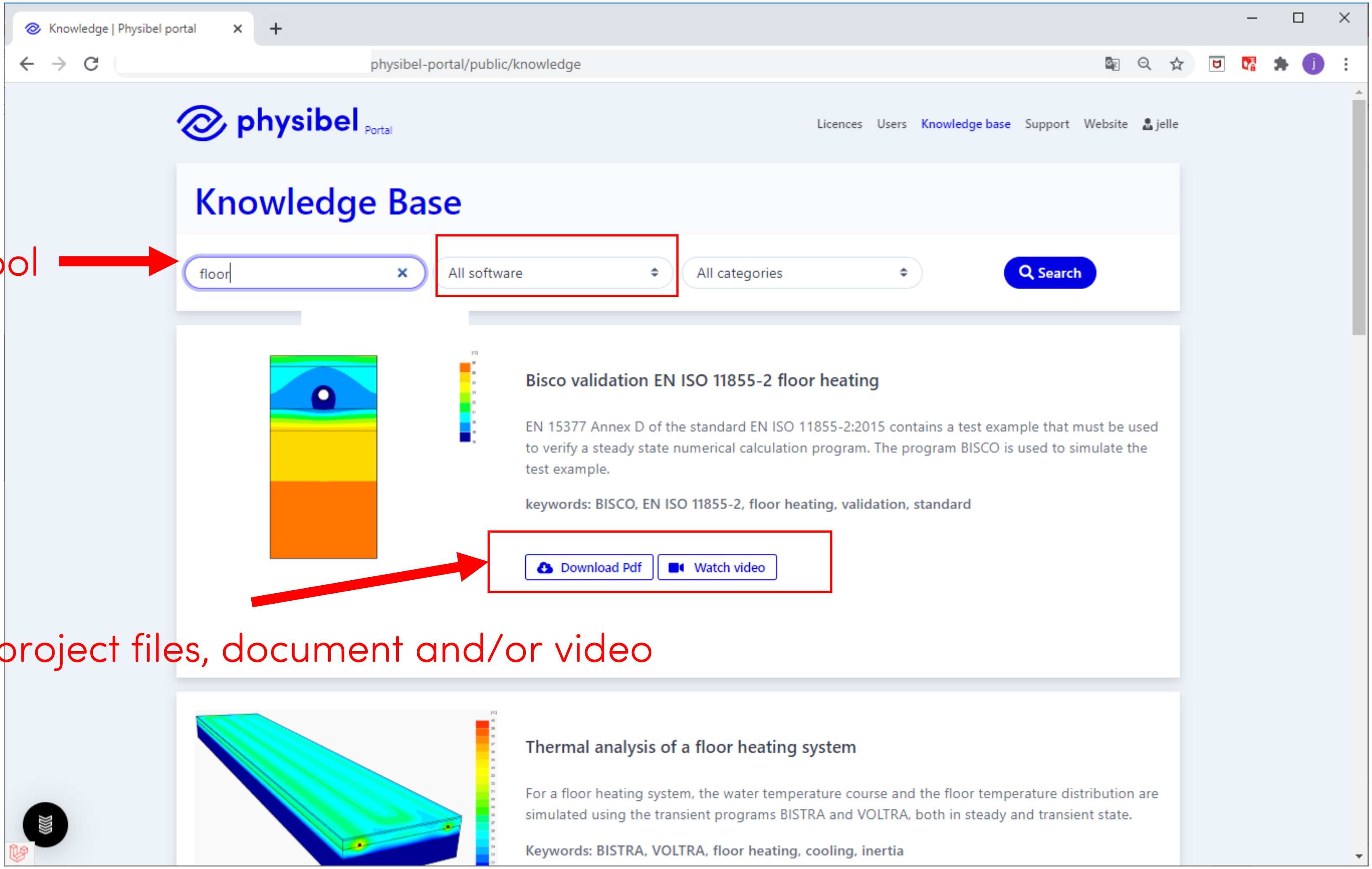
G.2 Knowledge Base: new tutorials and documentation

log in to portal via www.physibel.be



G.2 Knowledge Base: new tutorials and documentation

Search tool



Access project files, document and/or video physibel

BISCO v13 New program performances

www.physibel.be/bisco

downloadable program demo version