Welcome!

Webinar #2: SCRIPTS in Thermoflow Programs

• Introduction: Why Scripts?
• Scripts in GT PRO, GT MASTER and THERMOFLEX
• Script Definition
• Managing Script Variables
• Examples

* Q & A Session

Presenter: IGNACIO MARTIN (SPAIN)
Support: Meritt Elmasri (U.S. HQ)
Thermoflow Training and Support

- Standard Training
- On-site Training course
- Advanced Workshop
- Webinars when new version is released
- Help, Tutorials, PPT, Videos, ...
- Technical Support

→ Feature Awareness Webinars
Feature Awareness Webinars

1- Assemblies in THERMOFLEX

2- Scripts in Thermoflow Programs
INTRODUCTION: Why Scripts?

- Philosophy of Thermoflow software
- How to interact with Thermoflow programs
  - ELINK
  - ULINK
  - User Defined Components in TFX
  - Adjustment methods, Correction factors,
  - Scripts
SCRIPTS in:

- THERMOFLEX, Version 23, since 2013
- GT MASTER, Version 24, since 2014
- GT PRO, Version 26, since 2016
SCRIPTS:

Scripting functionality allows users to create and compute **custom outputs** or to **set certain inputs** using code written in the scripting language **Lua**.

*Special Note: Scripts can be dangerous. They can link to and run code and other programs that are not immediately visible from the script editing. Do not run a script that you think may contain malicious or harmful code.*
Basic Lua Documentation

THERMOFLEX uses the scripting language Lua, version 5.1.4.

Documentation in ➔ http://www.lua.org/

Compiled Windows binaries, libraries, and a code editor ➔ https://github.com/rjpcomputing/luaforwindows

Lua and Lua for Windows available under the terms of the MIT license ➔ http://opensource.org/licenses/mit-license.php.

Full online documentation for version 5.1: ➔ http://www.lua.org/manual/5.1/manual.html
SCRIPT Activation:

GT PRO

GT MASTER

THERMOFLEX

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SCRIPT Definition:

Script Name: HPT/HP Sourcing
3 Inputs
2 Outputs
Status: Computed successfully

Script Body:

```plaintext
-- Initialize output tables
app = {} -- Script Output Parameters
ifp = {} -- Thermoflow Input Parameters

-- Start wrapper function
function TFLw_Main(CallOrigin, ConvergenceStatus, ...)
  -- This code is automatically generated to place inputs into a local table for ease of use
  local sip = (n=select('#',...),...)

  -- User code begins here:
  -- Parse output values to the script output parameter array
  if sip[1] > 50 then
    ifp[1] = 0 -- Main HP process flow
    ifp[2] = 10 -- 1st HPT bleed stream mass flow
  else
    ifp[1] = 10 -- Main HP process flow
    ifp[2] = 0 -- 1st HPT sub flow
  end

  -- End wrapper function
end
```
SCRIPT Parameters:

**Custom Script Inputs:** name, description and Units (TFIP)

**Script Inputs** from program (GTP-GTM-TFX) : input parameters to be **determined** by the Script (TFIP)

**Script Outputs:** custom output parameters to be **computed** by the Script (SOP)

**Script Inputs:** inputs and outputs from the program **required** by the Script (SIP)

*(Custom Script Inputs must be added here)*

→ Caution: notice the difference on Units: “Current display” and “Native”

*Unit conversion within the script is left to the user*
SCRIPT Parameters:

1. Custom Input Parameters
   - Define custom input parameters for the model. The values of these parameters can be edited from the TFX Edit Inputs menu.
   - The custom inputs defined here are made available to any and all scripts in this file.

2. Script Output Parameters (SOP)
   - Define custom script output parameters to be computed by this script.

3. TFIX Input Parameters (TFIP)
   - Select THERMOFLUX input parameters to be determined by this script.
SCRIPT “Code”: 

```plaintext
-- Initialize output tables
sop = {} -- Script Output Parameters
tip = {} -- THERMOFLOW Input Parameters

-- Start wrapper function
function TFlm_time(CalOrigin, ConvergenceStatus, ...)

   -- This code is automatically generated to place inputs into a local
table for ease of use

   local sip = {n=select('i',...)

   -- User code begins here:
   local pi = 4 * math.pi

   -- Pass output values to the script output parameter array
   sop[1] = pi

   -- End wrapper function
   end
```
SCRIPT “Call Origin”

1. **At the beginning of computation** before anything else has been computed
   Allows a script to set THERMOFLEX input parameters before beginning the computation.

2. **During the main computation loop**
   Allows a script to set inputs during the computation instead of waiting for convergence. This can give a result faster, but is also more likely to make the model unstable.

3. **Just before the model is deemed converged** to give the script one last chance to change THERMOFLEX input parameters (TFIPs)
   Allows a script to set inputs that change the flow or pressure relational matrices

4. **At the end of computation** after all other outputs have been computed
   Allows a script to compute custom outputs using the final results of the computation.
   THERMOFLEX input parameters are not set at this time. Computation is over, so setting TFIPs to new values at this point would have no effect on the results.
Test SCRIPTS

![Thermoflow Script Manager](image)

- **Define Scripts**
  - Choose call origin: TFCO_BEGINNING, TFCO_LASTCHANCE, TFCO_END
  - Call Origin: 8
  - Convergence Status: 0
  - \( sp[1] \): HP process condensate return temperature: 250°F
  - \( sp[2] \): IP process condensate return temperature: 200°F
  - \( sp[3] \): Main HP process mass flow: 5 lb/s
  - \( sp[4] \): Main IP process mass flow: 5 lb/s

- **Test Script**
  - Set the script's input values and then click on the "Run Script" button to view the script's outputs.
Edit SCRIPT Inputs

THERMOFLEX

GT PRO

GT MASTER
Run SCRIPT

- Output Data File Compression
  - Use file compression when saving files
  - Do not use file compression
- Trust scripts?
  - Only answer "Yes" if you are certain that none of the scripts in this file contain malicious code.
- Script Trust Level
  - Always trust
  - Never trust
  - Always ask

Script computation finished. Number of loops = 1
Please view text output on System tab, Script Details sub-tab.
SCRIPT Outputs

GT PRO – GT MASTER

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SCRIPT Outputs

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SCRIPTS Compatible with

- Multiple Runs
- ELINK
- TFX: “Classic” Macros, Searcher
Import and Export SCRIPTS

**Importing: Things that are always preserved**
The following properties of an imported script are always preserved:
• Name and body
• Call origins
• Script Output Parameters

**Importing: Things that are never preserved**
The following properties of an imported script are never preserved:
• Script Input Parameters (sips) that refer to custom inputs
• Custom inputs, file-specific.

**Importing: Things that may be preserved**
Script Input Parameters (sips) and Thermoflow Input Parameters (tfips) are links to variables in the main program hosting the script. When a script is imported, the script will ask the main program (e.g. THERMOFLEX, GT PRO, or GT MASTER) if its sip and tfip variables are still available in the current file. If they are, the variables will be preserved. If they are not, then the variables will be cleared and the script itself will also be disabled.
This process may not be perfect. It is up to the user to ensure that all of an imported script's sips and tfips have been properly assigned, and to reassign them if necessary.
When importing a script exported from a different program (i.e. importing a script exported from THERMOFLEX into a GT PRO file, or a script made in GT PRO into a THERMOFLEX file, etc.), all sips and tfips will be cleared.
SCRIPTS Samples

**GT PRO:**
- (GTP_Script1)Different Condensate Return Temperature
- (GTP_Script2)Different Steam Export Prices
- (GTP_Script3)Script_DB_STkW

**GT MASTER:**
- (GTM_Script1)ExtractionSelector
- (GTM_Script2)ACC_Scheduling
- (GTM_Script3)CustomOutputs
- (GTM_Script4)GTDataFromExcel & (GTM_Script4)GTDataFromExcel.xls

**THERMOFLEX:**
- (S2-36)Load Scheduling 6-on-1 CC Plant
- (S2-37)Modeling M-on-N Plant Using Scripts
- (S5-22) SolarPV with Gas Turbine Backup using Scripting
- (S5-23) WindFarm with Gas Turbine Backup using Scripting
SCRIPTS Help:

**GT PRO**: Chapter 24

**GT MASTER**: Chapter 24

**THERMOFLEX**: Chapter 3.3

Contact THERMOFLOW Support at info@thermoflow.com