

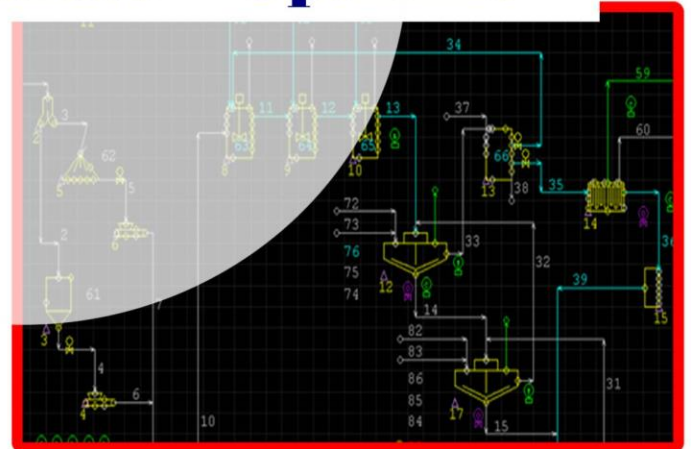
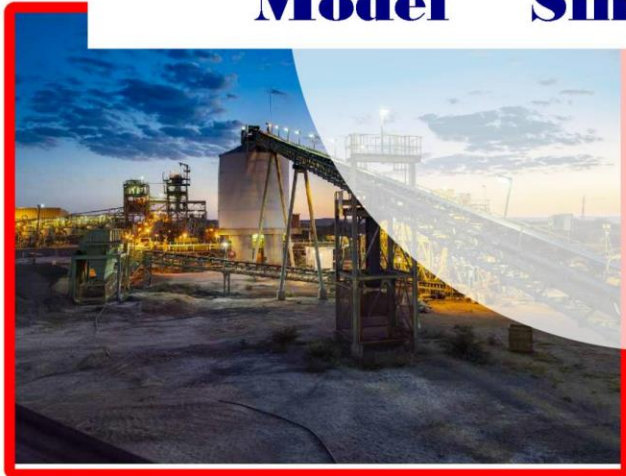


**PATFIO INVESTMENTS PVT (LTD) COMPANY**  
*Solution to your design problems & needs!*

# SIMULATION FOR MINERALS INDUSTRY TRAINING HANDBOOK 2020



**Model Simulate Optimize**



*Eng. P Chesa, 2020*

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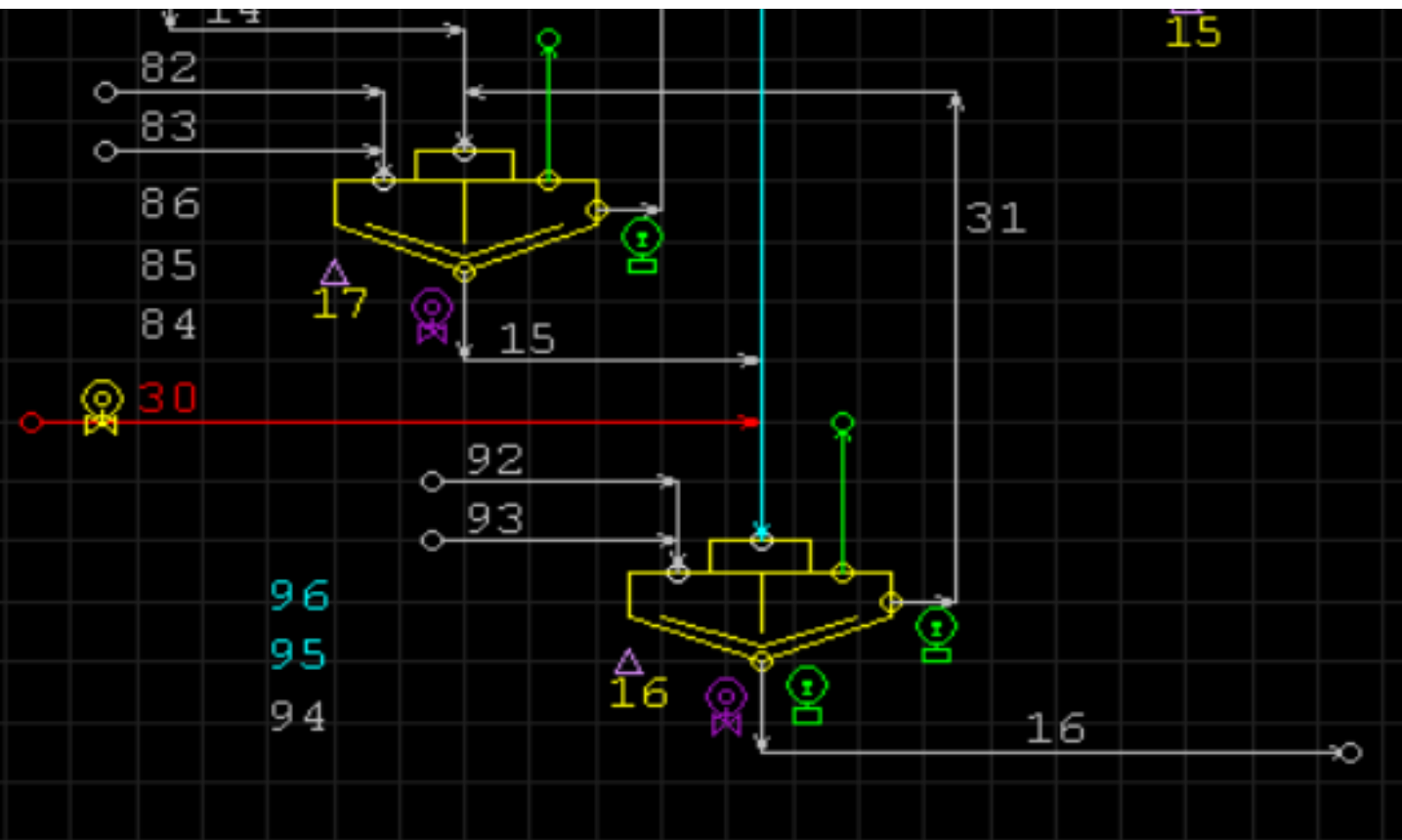
## PRACTICAL 8

- **ASSIGNMENT – PARTICIPANTS TO MODEL A SIMPLE UNIT OPERATION OR PROCESS**

# PRACTICAL 1

## NAVIGATING METSIM UI

# What can you see on this Flowsheet?





- Line colors:
  - Red=empty=red
  - White=solid
  - Blue=aqueous
  - Green=gas
  - Dark green=organic
  - Molten phases  
yellow/orange/dark red
- Number on lines:  
stream number or  
any chosen parameter


# RIBBONS IN METSIM


Open METSIM software and identify the following Ribbons.




 Calculate one unit operation – on activation any selected unit operation can be calculated.

 Calculate Current Section – on activation all unit operations in the current section will be calculated.

 Stop Execution - On activation will immediately stop flowsheet calculations. Used to abort calculations as determined by the user.

 Calculate Unit Operation Range – used to repeat calculations over the range determined by the user through SCAL.

 Calculate All Unit Operations – used to calculate the full flowsheet from any section. Useful for situations where the user may wish to observe flowsheet changes during simulation.

# Open any Model in METSIM folder

File>Open...retrieve model>local disk  
C>METSIM>MEX

# Some of the Flowsheets in METSIM

METSIM-2017.09 C:\METSIM\mex\lwx\DH5.sfw

Files Input Comp Merge Weather Dynamic Mine Heap Calc Display Engr Costs Optl OpX OpC Graphics Output Tools New Help Move

Dynamic Hydromet Simulation  
Demo Only - Not a Real Process!!!

Stream Number

MODEL PARAMETERS

GEN MIN1 MIN2 COM BEH  
HES BAS LAS SMS  
ADV DDV ANC

SECTION

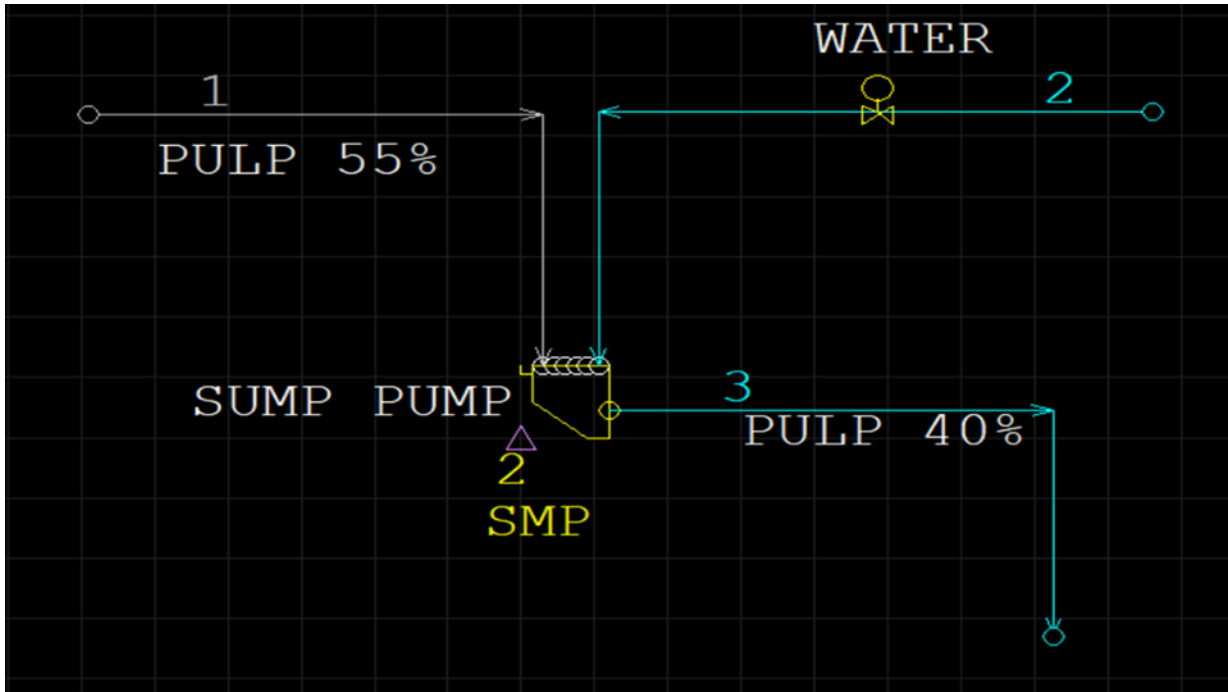
AGE 00:05:23 KEY #12345



# PRACTICAL 2

## SUMP TANK SIMULATION

# SUMP TANK SIMULATION



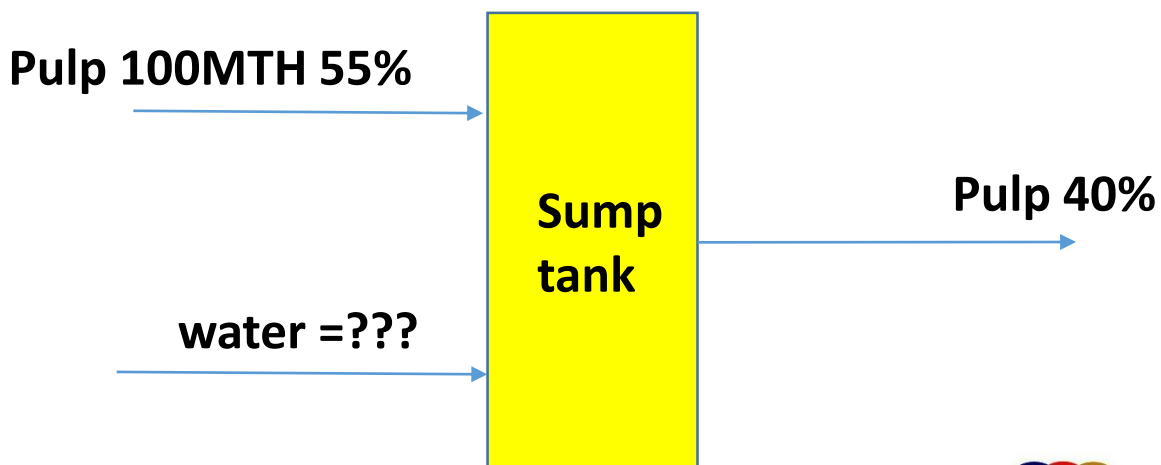
## OBJECTIVES

1. Know how to model
2. Know how to do material balancing
3. Know how to use controls
4. Know how to add texts on unit operations and streams

# PROBLEM DESCRIPTION

A Pulp feed at 55% ( $\text{SiO}_2$ ) enters a sump tank alongside a water stream.

You are to determine the amount of water needed to achieve a 40% solids content in the outlet stream. The residence time of the sump tank is 25mins.



# PROCEDURE

1. Add a Sump from the GEN
  2. Add streams
  3. Rename the streams
  4. Add elements and components “ water & quartz ”
  5. Edit the components by deleting unnecessary components.
  6. Edit the parameters to “Metric tonnes /hr ”
  7. Add components to the streams. To pulp percentage solids @55% to make a total of 55mt/hr solids in the dialogue box.
  8. Add 10mt/hr H<sub>2</sub>O to water stream
  9. Edit the sump unit operation and add residence time
  10. On the display value function tab add “% solids” to the streams.
- Calculate the unit operation and discuss your results with your neighbor. [Did you achieve the desired Outlet stream parameters?](#)

# CONFIGURE STREAM 1

METSIM-2017.09 C:\Users\USER\Desktop\SUMP PUMP SIMULATION2.SFW

Files Input Comp Merge Weather Dynamic Mine Heap Calc Display Engr Costs Opcl OpC OpcO Graphics Output Tools New Help Move

Stream 1

0

Output Level 0 Design Factor 0 Maximum Flow

Box Number 0 Variables 1 2 3

1

Label

OK Cancel

	MT/HR
SOLIDS	55
SID-ORG	0
AQUEOUS	45
ORGANIC	0
MOLTEN	0
MATTE	0
SLAG	0
GAS	0
TOTAL	100
% SOLID	0.55
Control C	0
Temp C	20
Temp F	68
Pres kPa	101.325
Pres kPag	0
Pres psia	14.695949
Pres psig	0
Time	1
Gal/min	289.855
L/sec	18.286998
L/min	1097.2199
M3/hr	65.833194
MFD/hr	65.764686

Wt. Frac.	Mol. Frac.	MT/HR
1	1	55

	Wt. Frac.	Mol. Frac.	MT/HR
H	1	0	0
O	0	0.5325606	0.6666666
Si	14	0.4674393	0.3333333
			25.709164

SEEN MIN VFL COM GEN  
 HBS GAS TAS MBS  
 ADV DEV ANC  
 PRG FFD  
 PSC PHC  
 FBC SPI  
 INS TOT

1 2 3 4 5 6 7  
 8 9 10 11 12 13 14  
 15 16 17 18 19 20 21  
 22 23 24 25 26 27 28  
 29 30 31 32 33 34 35  
 36 37 38 39 40 41 42  
 43 44 45 46 47 48 49  
 50 51 52 53 54 55 56  
 57 58 59 60 61 62 63  
 64 65 66 67 68 69 70  
 71 72 73 74 75 76 77  
 78 79 80 81 82 83 84  
 85 86 87 88 89 90 91  
 92 93 94 95 96 97 98  
 99 100 101 102 103 104 105  
 106 107 108 109 110 111 112  
 113 114 115 116 117 118 119  
 120 121 122 123 124 125 126  
 127 128 129 130 131 132 133  
 134 135 136 137 138 139 140



# CONFIGURE STREAM 3

The screenshot shows the 'Stream 3' configuration window in METSIM-2017.09. The window title is 'Stream 3' and it contains several input fields and data tables. The background shows a simulation interface with 'PULP' and 'SUMP' labels and yellow arrows pointing to them.

**Stream 3 Configuration Fields:**

- Output Level: 0
- Design Factor: 0
- Maximum Flow: 0
- Box Number: 0
- Variables 1 2 3: 0
- Label: 0

**Stream 3 Data Tables:**

	MT/HR		Wt. Frac.	Mol. Frac.	MT/HR	
SOLIDS	55	S102	1	1	55	
SOL-DISC	0					
AQUEOUS	82.5	H	1	0	0	
ORGANIC	0	O	8	0.5325606	0.6666666	29.290836
MOLTEN	0	S1	14	0.4674393	0.3333333	26.709164
WATTS	0					
SLAG	0					
GAS	0					
TOTAL	137.5					
% SOLID	0.4					

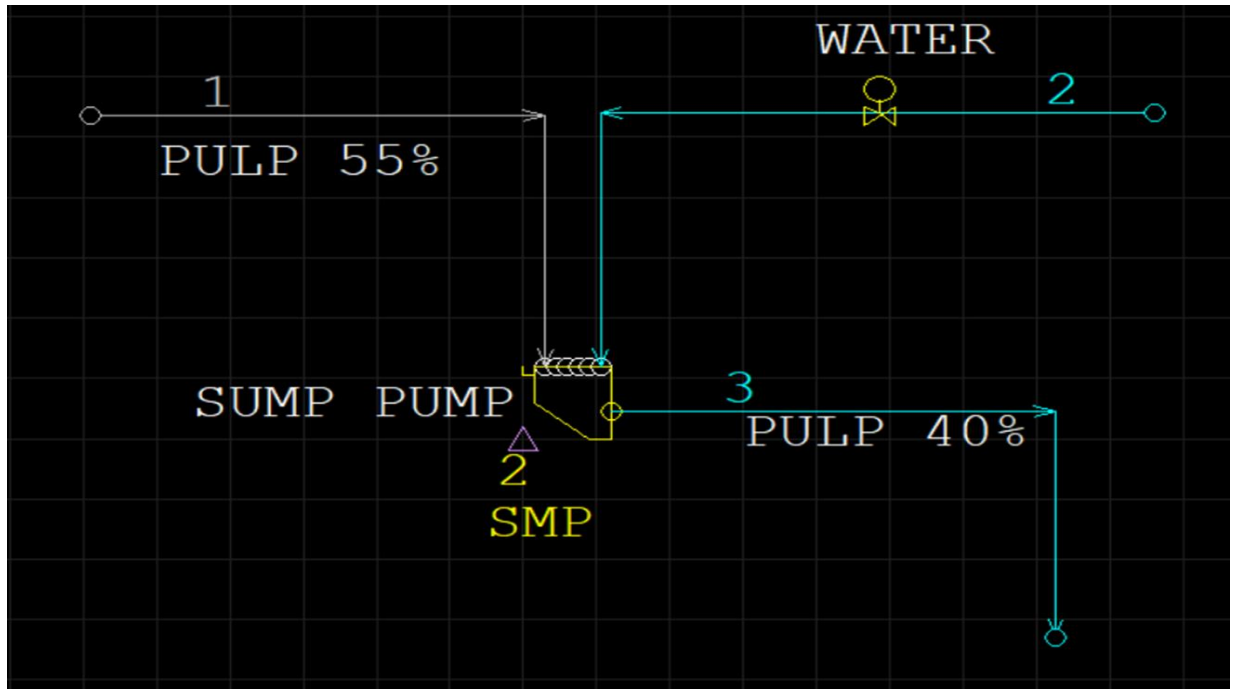
**Stream 3 Properties:**

- Control C: 0
- Temp C: 20
- Temp F: 68
- Press MPa: 101.325
- Press kPa: 0
- Press psi: 14.695949
- Press psia: 0
- Time: 1
- Gal/min: 455.25056
- L/sec: 28.721831
- L/min: 1723.3099
- MS/hr: 103.39859
- M3/hr: 103.27299

**Stream 3 Flow Data Table:**

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35
36	37	38	39	40	41	42
43	44	45	46	47	48	49
50	51	52	53	54	55	56
57	58	59	60	61	62	63
64	65	66	67	68	69	70
71	72	73	74	75	76	77
78	79	80	81	82	83	84
85	86	87	88	89	90	91
92	93	94	95	96	97	98
99	100	101	102	103	104	105
106	107	108	109	110	111	112
113	114	115	116	117	118	119
120	121	122	123	124	125	126
127	128	129	130	131	132	133
134	135	136	137	138	139	140

# Add Instruments & control to achieve 40%



PERCENT STREAM CONTROL

PSC | Notes |

PERCENT STREAM CONTROL is used to regulate the concentration of a component or fraction of solids in the feed to a unit operation.

- 1- The module controls one input stream flowrate in order to maintain a specified concentration or fraction solids in the feed streams.
- 2- This control module may be placed on any unit operation.
- 3- The control action is performed prior to any chemical or phase changes, therefore, the values for exit streams may differ from the values set for input streams.

ON  Controller On

CN 1 Control Loop Number

TY PSC Controller Type: FRC, FFC, PSC, FBC

Controller description

ID CONTROL %

OP 2 Unit operation

SI 2 \* Number of the input stream to be adjusted

PS 0.40 \* Concentration or fraction solids

CO 0 Calculation option. 0-Weight fraction 1-Mole fraction

CM 0 Component number. 0 for solids

OK Cancel Help



- From the CTL tab, add percentage stream control “PSC” and configure as below.

PERCENT STREAM CONTROL

PSC | Notes

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ON  Controller On

CN  Control Loop Number

TY  Controller Type: FRC, FFC, PSC, FBC

Controller description

ID

OP  Unit operation

SN  \* Number of the input stream to be adjusted

PS  \* Concentration or fraction solids

CO  Calculation option. 0-Weight fraction 1-Mole fraction

CM  Component number. 0 for solids

OK Cancel Help

# Run the model and observe how your model ...

METSIM-2017.09 C:\Users\USER\Desktop\SUMP PUMP SIMULATION2.SFW

Files Input Comp Merge Weather Dynamic Mine Heap Calc Display Engr Costs Opcl OpCk OpCO Graphics Output Tools New Help Move

AGE 00:18:10 | KEY #12345

DISPLAY VALUE FUNCTIONS FOR ST

GEN MIN MTL COM BEN  
HBS BKS EKS MBS  
ADY ODY ANC

FRC FFO

PSC PHC

FBC SFI

INS TOT

1 2 3 4 5 6 7  
8 9 10 11 12 13 14  
15 16 17 18 19 20 21  
22 23 24 25 26 27 28  
29 30 31 32 33 34 35  
36 37 38 39 40 41 42  
43 44 45 46 47 48 49  
50 51 52 53 54 55 56  
57 58 59 60 61 62 63  
64 65 66 67 68 69 70  
71 72 73 74 75 76 77  
78 79 80 81 82 83 84  
85 86 87 88 89 90 91  
92 93 94 95 96 97 98  
99 100 101 102 103 104 105  
106 107 108 109 110 111 112  
113 114 115 116 117 118 119  
120 121 122 123 124 125 126  
127 128 129 130 131 132 133  
134 135 136 137 138 139 140

55.00  
PULP 55%

WATER

0.00

SUMP PUMP  
2  
SMP

40.00  
PULP 40%

# DISCUSSION POINTS

Did you achieve the desired parameters?

What have you learnt about controls?

How much water is needed to form the desired pulp?

Repeat the procedure to achieve a pulp of 70% solids (SiO<sub>2</sub>)