Chemical Engineering 512

Nuclear Reactor Transient Modeling

Lecture 15

PYGI Restart Pressurizer, 2 Phase flow

Spiritual Thought

"I have always been amazed that [Jesus] could sleep through a storm on the Sea of Galilee so serious and severe that His experienced fishermen disciples thought the ship was going down. How tired is that? How many sermons can you give and blessings can you administer without being absolutely exhausted? The caregivers have to have care too. You have to have fuel in the tank before you can give it to others."

Elder Jeffrey R. Holland

Objectives

- Learn about PYGI and how to use it
- Learn about restart files and how to use them
- Learn about pressurizers
- Pressurizer example
- Learn about 2-phase flow in RELAP

PYGI

- *PYGMALION (or Pygi for short) is a RELAP5 utility program that updates the initial condition information within a RELAP5 input file. These initial conditions are obtained by performing steady-state calculations, the final results of which are written to a restart/plot (rstplt) file for subsequent use. Pygi accesses the rstplt file, obtains the final conditions for each component of the system model, and replaces the appropriate cards in the original input file with cards containing the new conditions. The new input file then accurately represents the hydrodynamic state of the problem as it was at the end of the steady-state initialization run.*

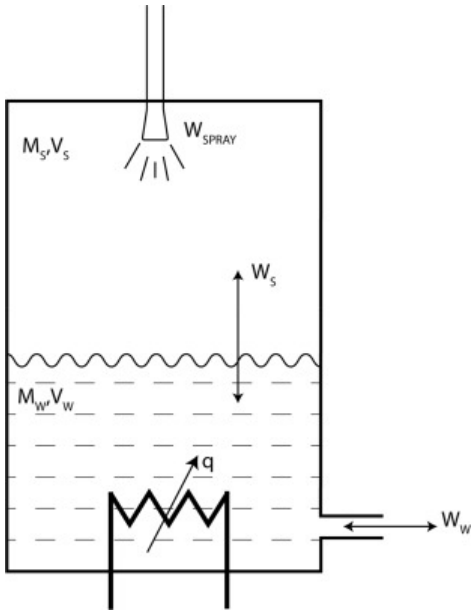
https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/DE2001786642.xhtml

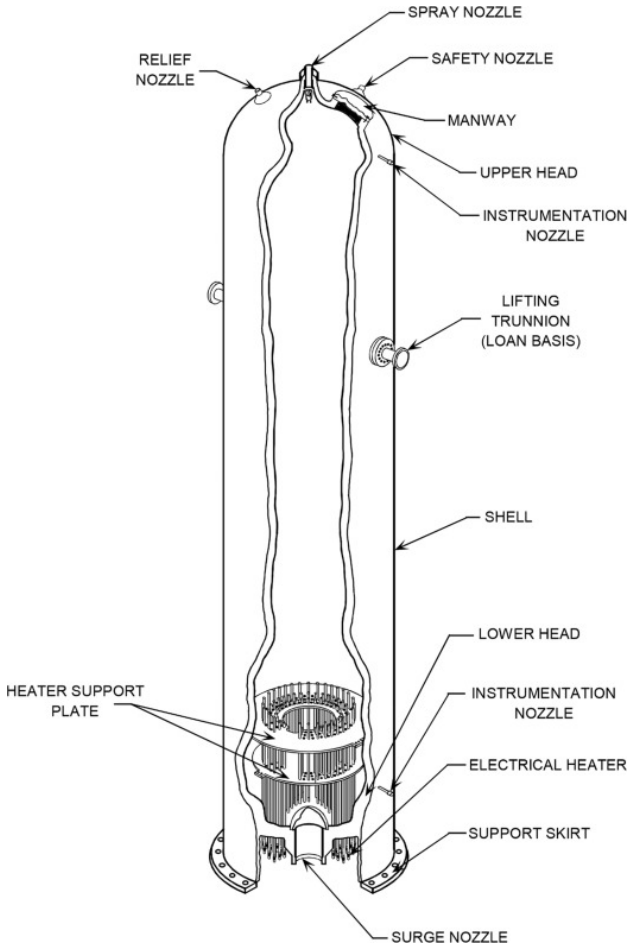
Command Line

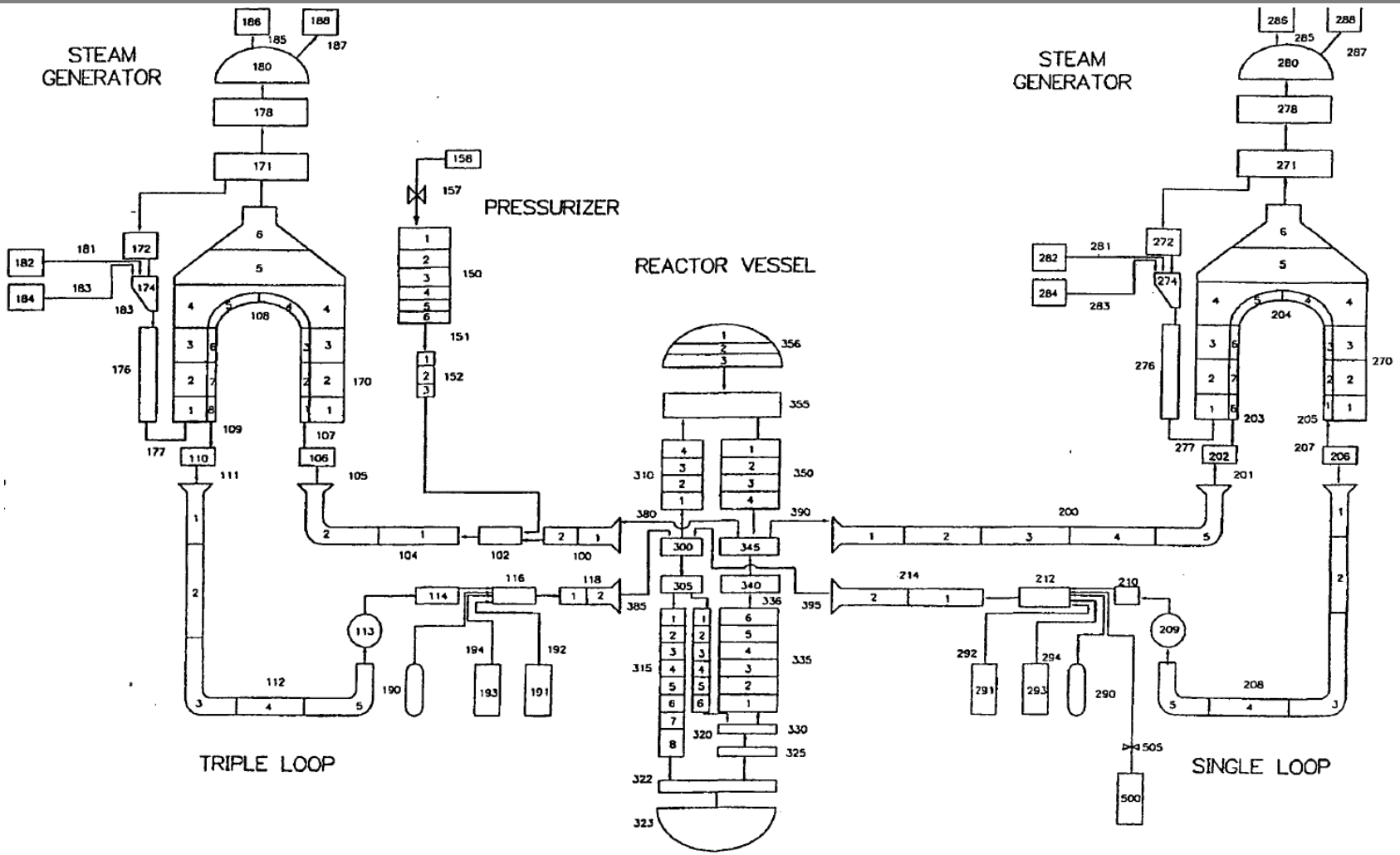
pygi.exe -r ABTRsecondarytesting.r -t 400.0
< ABTRsecondarytesting.i > ABTRpygi.i

- -r → name of restart file to draw data from
- -t → restart time to use as basis
- < → input file for the given restart file
- > → the new input file created

Pressurizers

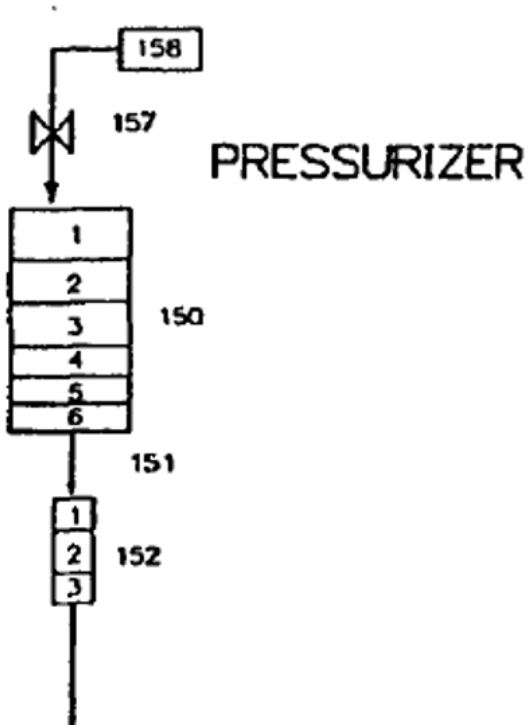





STEAM GENERATOR
PRESSURIZER
REACTOR VESSEL
STEAM GENERATOR
TRIPLE LOOP
SINGLE LOOP

Pressurizer Input

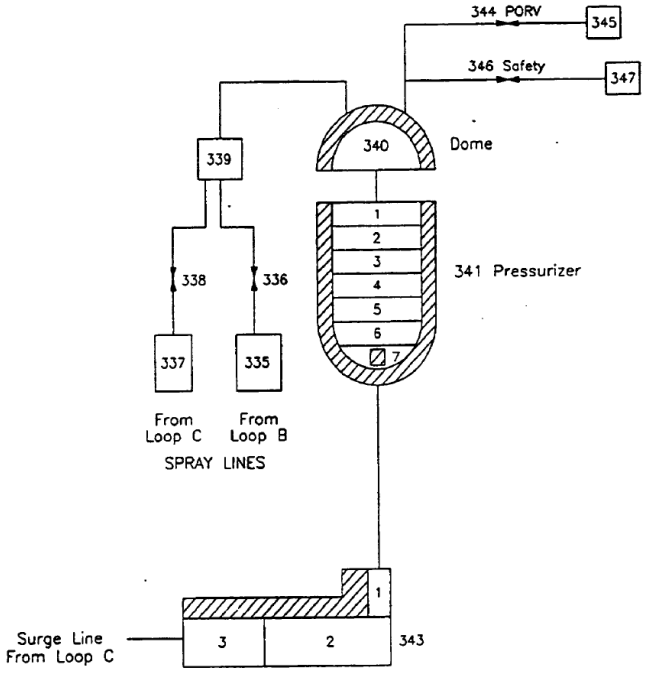
- It is a pipe.




```
*********************************
*       Pressurizer - 150       *
*********************************
*          Name      Type
1500000    pres      pipe
*          NumOfVolumes
1500001    6
*          Area                        VolNum
1500101    36.746                      6
*          Length                      VolNum
1500301    9.7922                      2
1500302    12.2403                     3
1500303    9.7922                      4
1500304    4.8961                      5
1500305    2.4481                      6
*          InclAng                     VolNum
1500601    -90.                        6
*          Roughness  HydraulicDiam    VolNum
1500801    0.0        0.0              6
*          Af         Ar               JunNum
1500901    0.0        0.0              5
*          tlpvbfe                     VolNum
1501001    0000000                     6
*          Jefvcahs                    JunNum
1501101    00000000                    5
*          Ebt   Initial-Conditions          VolNum
1501201    2     2242.45   1.     0.   0 0   1
1501202    2     2242.85   0.943  0.   0 0   2
1501203    2     2244.65   0.0    0.   0 0   3
1501204    2     2247.55   0.0    0.   0 0   4
1501205    2     2249.45   0.0    0.   0 0   5
1501206    2     2250.35   0.0    0.   0 0   6
*          Vel/Mfr
1501300    1
*          Liquid  Vapor  Interface  JunNum
1501301    0.0     0.0    0.0        5
****
```

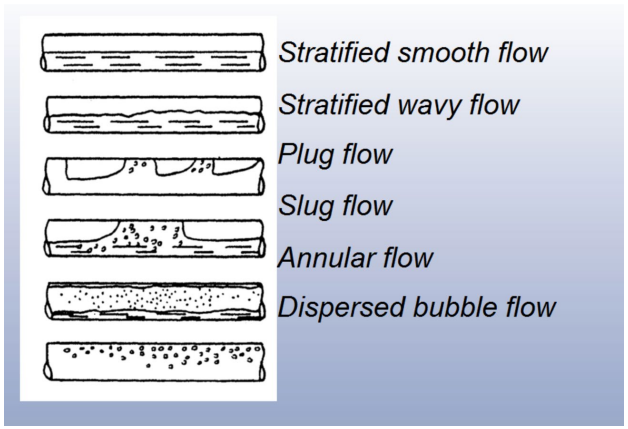
Pressurizer: According to RELAP Manuals

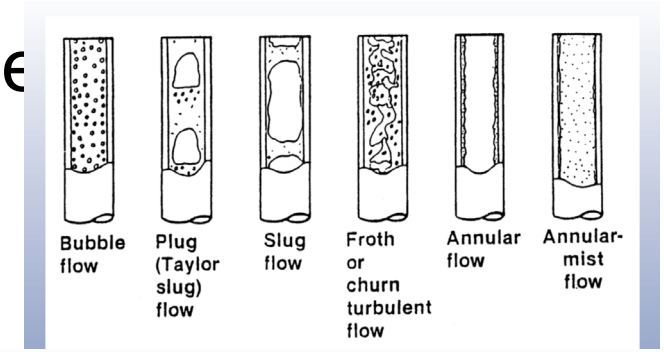
- Plant data shows 7 is good # of Vol
- PORVs – 344
- Safety Valves – 346
- Slight over pressurization – Spray Valves open (338, 336)
- Heat Structures
  - Heater operation
  - Heat loss

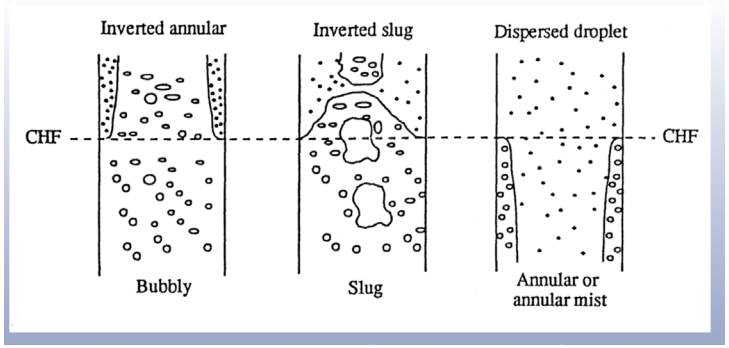


2-Phase Flow

- All RELAP Components model 2-phase flow
  - Including pumps (nee

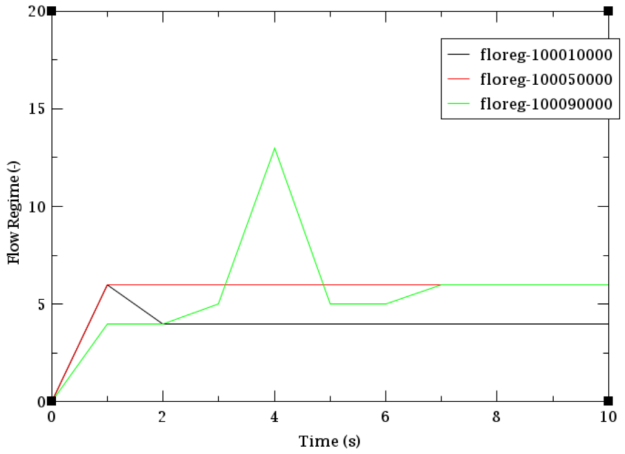






2-Phase Flow Example

- Remember HW1?
- What was happening?



Flow regime	Three-letter code (major edits)	Number (minor edits/plots)
High mixing bubbly	CTB	1
High mixing bubbly/mist transition	CTT	2
High mixing mist	CTM	3
Bubbly	BBY	4
Slug	SLG	5
Annular-mist	ANM	6
Mist-pre-CHF	MPR	7
Inverted annular	IAN	8
Inverted slug	ISL	9
Mist	MST	10
Mist-post-CHF	MPO	11
Horizontal stratified	HST	12
Vertical stratified	VST	13
ECC mixer wavy	MWY	14
ECC mixer wavy/annular-mist	MWA	15
ECC mixer annular-mist	MAM	16
ECC mixer mist	MMS	17
ECC mixer wavy/slug transition	MWS	18
ECC mixer wavy-plug-slug transition	MWP	19
ECC mixer plug	MPL	20
ECC mixer plug-slug transition	MPS	21
ECC mixer slug	MSL	22
ECC mixer plug-bubbly transition	MPB	23
ECC mixer bubbly	MBB	24

Assignment

- Homework 8 due Tuesday (10/26) at midnight

FINAL PROJECT