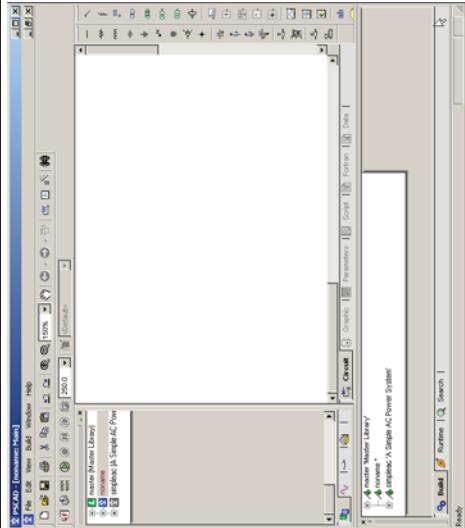


# ***U*** ***I*** Creating a file in PSCAD/EMTDC vers 4.2

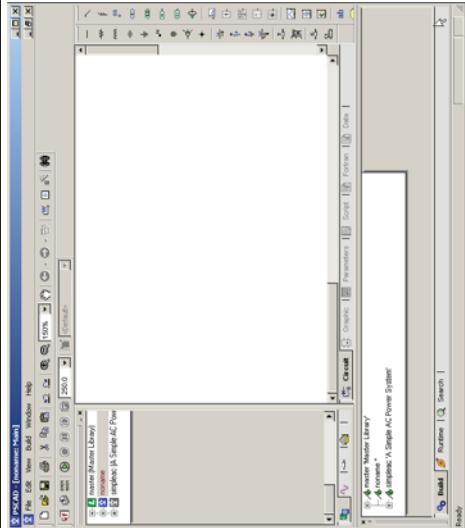
ECE 525  
Lecture 13



- Create new project
- Set project as active (blue icon)
- Double click on project to open schematic drawing pallet
  - » Can view an inactive project by not run it

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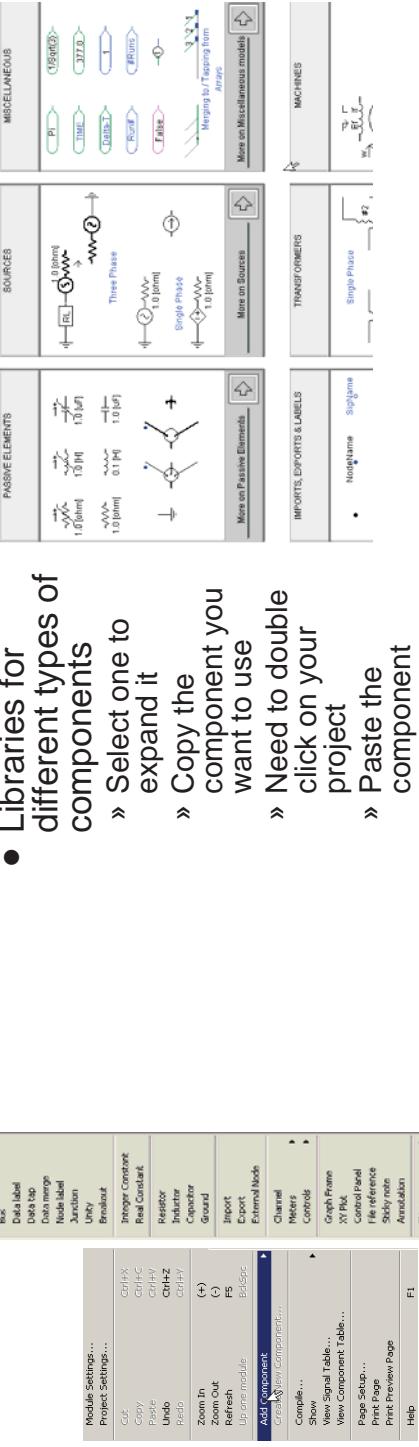
# ***U*** ***I*** Adding components (1)



- A few basic components in bars on right of screen

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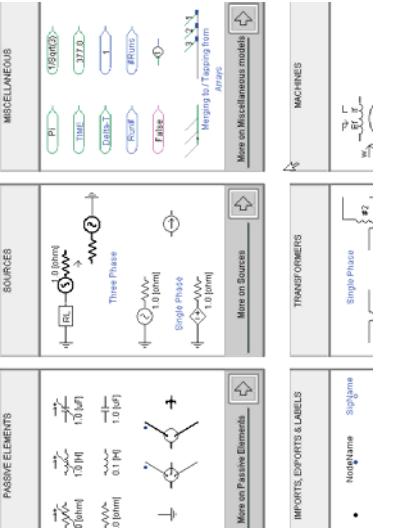
# ***U*** ***I*** Adding components (2)



- Can also add components by right clicking mouse in drawing area
- » Add Component

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# ***U*** ***I*** Adding Components (3) Master Library



- Libraries for different types of components
  - » Select one to expand it
  - » Copy the component you want to use
  - » Need to double click on your project
  - » Paste the component

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3

4

ECE 525  
Lecture 13

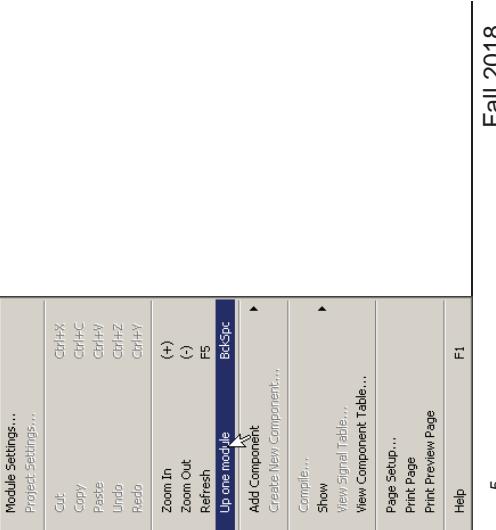
# **U<sub>I</sub>** Moving Up Modules

ECE 525  
Lecture 13

# **U<sub>I</sub>** Setting up your simulation

ECE 525  
Lecture 13

- When you are in a submodule you can move up with:



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- Right click in drawing area
  - » Select “Project Settings”

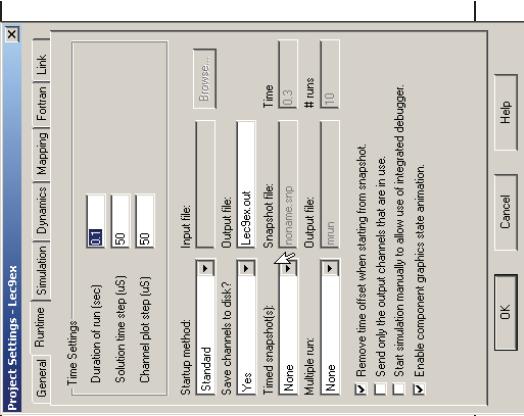


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# **U<sub>I</sub>** Project Settings

ECE 525  
Lecture 13

- Usually interested in “Runtime”
  - » Duration
  - » Solution time step
  - » Channel plot step
- May want to save channel to disk
  - » First configuration

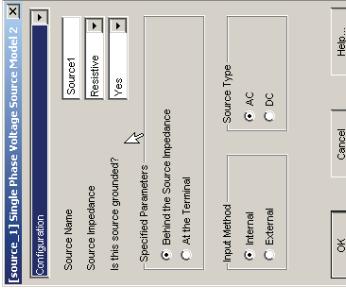


7

# **U<sub>I</sub>** Adding a Single Phase Source

ECE 525  
Lecture 13

- Copy source from library
  - » Double-click for dialog box
- Several pulldown menus
  - » First configuration



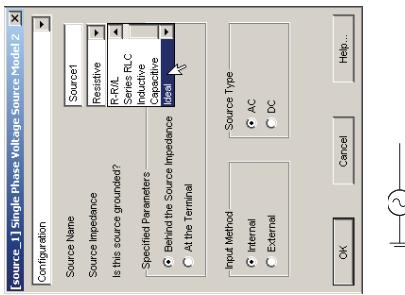
8

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# $U_I$ Resistors, Capacitors, Inductors

ECE 525  
Lecture 13

- Enter source name
- Source impedance
  - » For example ideal
    - Circuit symbol changes when done
  - Can also specify
    - » Grounding
    - » AC/DC
    - » Input internal or external
      - External allows user interactive or control loop

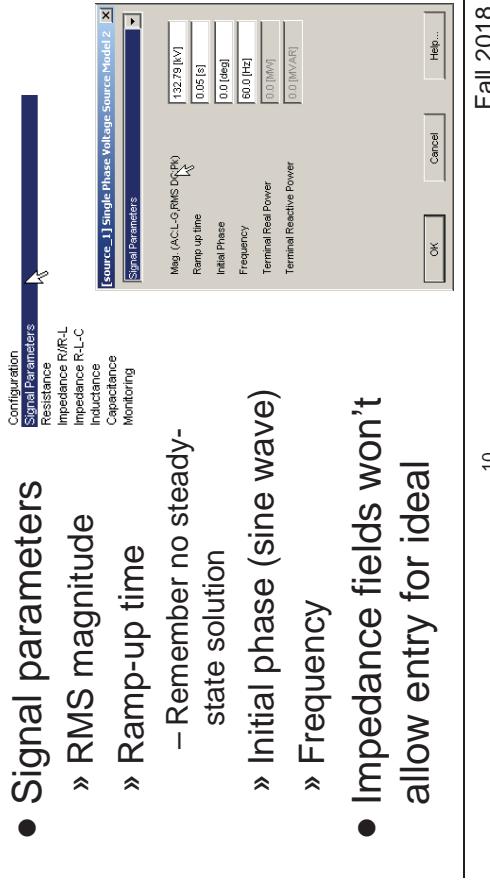


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# $U_I$ Source Configuration

ECE 525  
Lecture 13

- Signal parameters
  - » RMS magnitude
  - » Ramp-up time
    - Remember no steady-state solution
  - » Initial phase (sine wave)
  - » Frequency
- Impedance fields won't allow entry for ideal

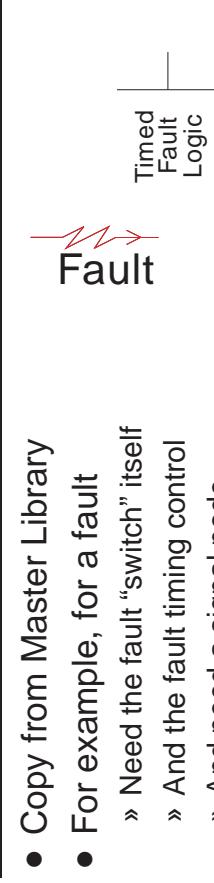


10 Fall 2018

# $U_I$ Switches and Faults

ECE 525  
Lecture 13

- For single phase branches can get from menus in window or master library
  - » Need to get from master library for polyphase
  - » Have option of 3 phase view of single line diagram view in later versions of program
  - Enter R in ohms, L in H and C in  $\mu\text{F}$



- Similar for a breaker
  - » Need three parts

11 Fall 2018

# $U_I$ Switches and Faults

ECE 525  
Lecture 13

- Copy from Master Library
  - For example, for a fault
  - » Need the fault "switch" itself
  - » And the fault timing control
  - » And need a signal node
  - » Signal name matches input name for fault (default is "Fault")
  - Similar for a breaker
  - » Need three parts

12 Fall 2018

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# $U_I$

## Faults

ECE 525  
Lecture 13

# $U_I$

## Faults

ECE 525  
Lecture 13

- Configuration:
  - » Fault name (control input)
    - Must match signal\_name
  - » Clearing and chopping are for switches
- Main data
  - » On and Off resistance (same for switches—open close)

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# $U_I$

## Faults

ECE 525  
Lecture 13

- Internal Output
  - » Can request current output (can reduce node count)
- Signal name:
  - » Set to match fault control input

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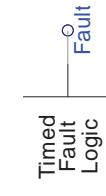
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# $U_I$

## Fault Timed Logic

ECE 525  
Lecture 13

- Set start time and duration of fault
- Attach signal name to end of line on icon:
  - » Set to match fault control input



# $U_I$

## Fault Timed Logic

ECE 525  
Lecture 13

- Configuration
  - » Breaker name is again control input
- Can specify interrupting current
  - » Current chopping limit
- Preinsertion resistance
  - » Current limiting R
- Symbol type

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# $U_I$

## Faults

ECE 525  
Lecture 13

- Internal Output
  - » Can request current output (can reduce node count)
- Signal name:
  - » Set to match fault control input

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# $U_I$

## Faults

ECE 525  
Lecture 13

- Configuration
  - » Breaker name is again control input
- Can specify interrupting current
  - » Current chopping limit
- Preinsertion resistance
  - » Current limiting R
- Symbol type

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# $U_I$

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Lecture 13

## Breakers

- Main Data
  - » Open/Closed resistance
- Preinsertion

The screenshot shows two stacked dialog boxes. The top box is titled '[breaker1] Single Phase Breaker' and contains 'Breaker Main Data' fields: Breaker OPEN Resistance (1E6 [ohm]), Breaker CLOSED Resistance (0.005 [ohm]), and a 'Name for Breaker Status' field (IS1). The bottom box is also titled '[breaker1] Single Phase Breaker' and contains 'Pre-Insertion Data' fields: Pre-Insertion Resistance (0.1 [ohm]), Time Delay for Closing Breaker (0.0 [s]), Time Delay for bypassing Pre-ins. (0.05 [s]), and checkboxes for Post-Insertion removal ('at next current zero' and 'after a specified time'). A 'Minimum Time for Post-Ins Removal' field (0.005 [s]) is also present.

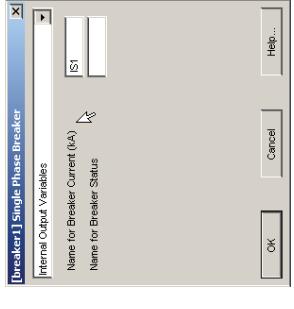
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# $U_I$

ECE 525  
Lecture 13

## Breakers

- Output data
  - » Current measure
    - Name appears on circuit symbol



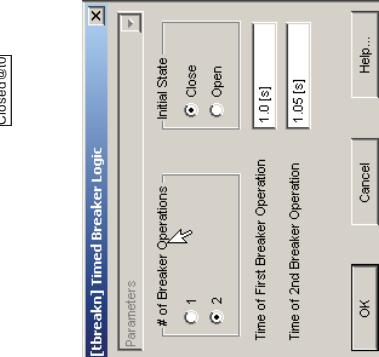
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# $U_I$

ECE 525  
Lecture 13

## Connecting circuit together

- Wire icon on top toolbar
  - » Pencil symbol appears
  - » Trace with left mouse clicks
  - Click each time change direction
  - » Right click or escape to complete
  - Right click lets you select points to rescale
- “Junction” to connect wires as cross each other (otherwise disconnected)
  - » Get from right click in drawing space



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ECE 525  
Lecture 13

## Breaker Timing Logic

- Controls timing of switching
  - » Again need signal input to match breaker control
- Timing control
  - » Number operations
  - » Initial state
  - » Timing of operations

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20

# $U_I$ Voltage and Current measurements

$U_I$

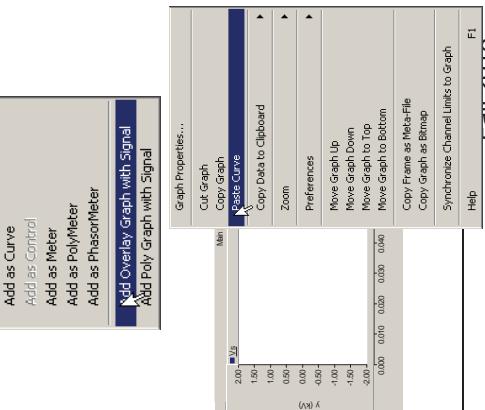
ECE 525  
Lecture 13

- Voltage measurements
  - » Can do line to ground and arbitrary
    - Need to connect to circuit
    - Name the measurement (default is Ea)
  - Current measurement
    - » Need to connect to the line, don't copy on top of a wire.

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# $U_I$ Input/Output Reference Graphs

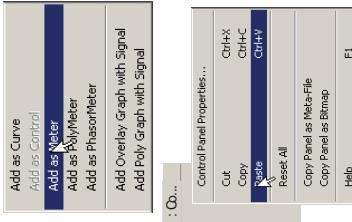
- Several Options
  - » Add Overlay Graph Most Common
  - » If choose "Add as Curve"
  - » Paste to existing graph
    - Right click in white part



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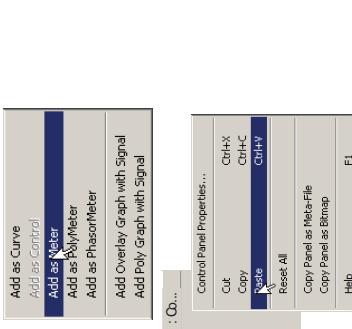
# $U_I$ Input/Output Reference Meters

- Add as Meter
  - Then select put a control panel in your drawing (from right side tool bars or right click of mouse)
    - » Right click - Paste



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Lecture 13



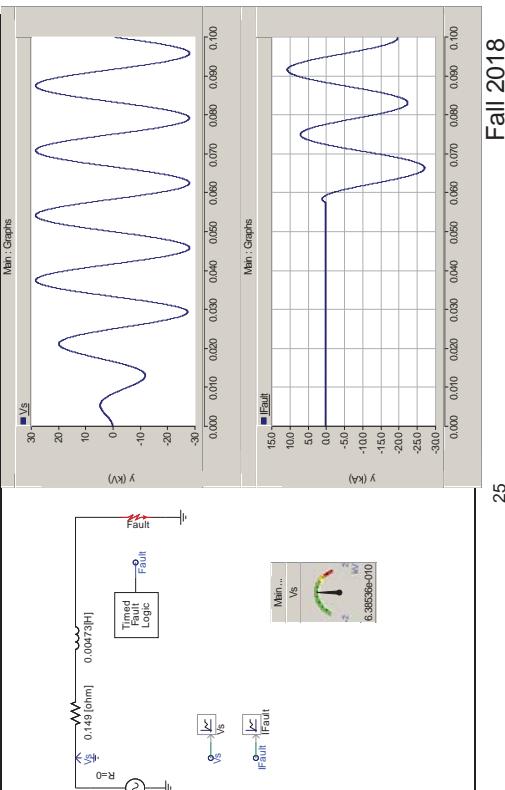
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Lecture 13

# $U_I$ Complete Circuit

ECE 525  
Lecture 13

## Complete Circuit: without graphs shown

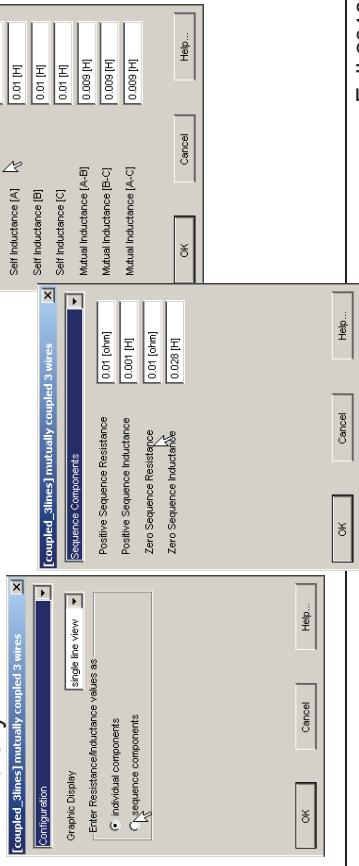


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# $U_I$ Coupled RL: EMTDC

ECE 525  
Lecture 13

- Choose Mutually coupled wires from Master Library

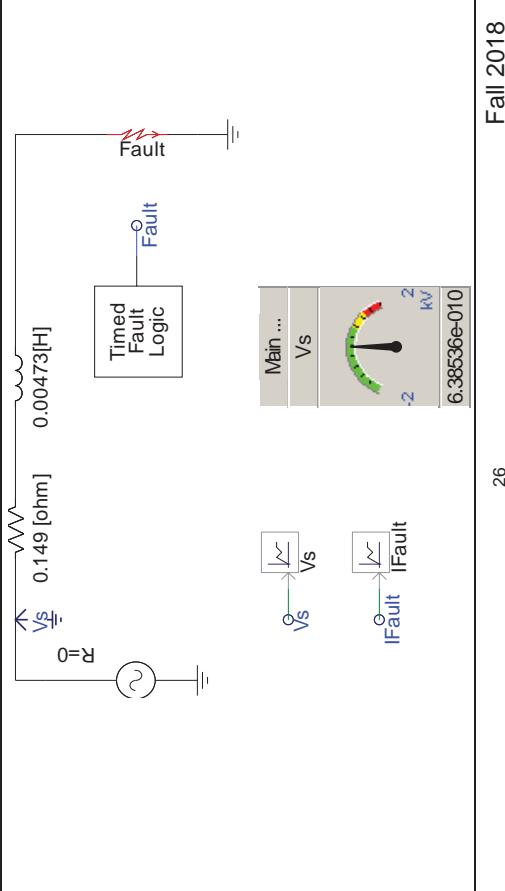


27

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# $U_I$

ECE 525  
Lecture 13



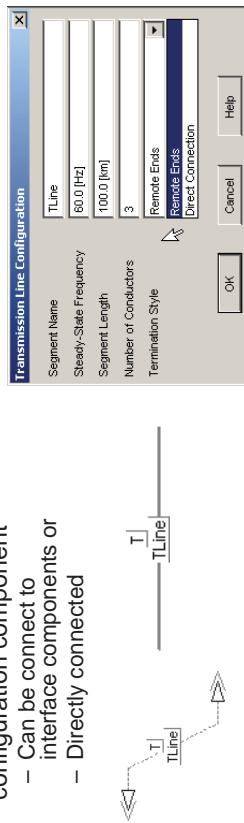
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# $U_I$ Distributed Parameter Line:

## EMTDC: Steps 1 and 2

ECE 525  
Lecture 13

- Two interface options:
  - Step 1: Connect Interface Component into Circuit
  - Step 2: Then copy in TLINE configuration component
    - Can be connect to interface components or
    - Directly connected



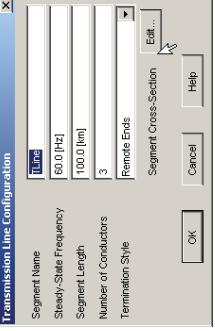
26

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# $U_I$ Distributed Parameter Line: EMTDC: Steps 3 and 4

# $U_I$ Distributed Parameter Line: EMTDC: Steps 5

- Step 3: Next choose Edit:
- Step 4: Copy Line Model and Options Box from Master Library:  
» In this case choose Bergeron (others later)



# $U_I$ Distributed Parameter Line: EMTDC: Steps 5-cont.

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**[Line\_ManualY2] Line/Cable Constants Manual Data Entry**

File Path: C:\sample\Tline

Y2 Input File Name: FileA.Y2

Path to Input File: C:\sample\Tline\fileA.y2

Y2 Delta Given Y: Total

Y2 Per Node: Total

Y2 Direct Entry:

Y2 Direct Entry? Yes

+ve Seq. Resistance	36254e-4 [ohm/m]
+ve Seq. Inductive Resistance	3031e-6 [ohm/m]
+ve Seq. Capacitive Resistance	302151 [Mfarad/m]
0 Seq. Resistance	37980e-3 [ohm/m]
0 Seq. Inductive Resistance	13277e-2 [ohm/m]
0 Seq. Capacitive Resistance	41934 [Mfarad/m]
0 Seq. Mutual Resistance	3798e-3 [ohm/m]
0 Seq. Mutual Inductive Resistance	1e-2 [ohm/m]
0 Seq. Mutual Capacitive Resistance	3500.0 [Mfarad/m]

OK Cancel Help...

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- Step 5: Choose manual entry of X,Z

**[Line\_ManualY2] Line/Cable Constants Manual Data Entry**

Data Entry Method: R,X,Y,C (p.u.)

0 Seq. Data Representation? Enter 0 Seq. Data  
Estimate 0 Seq. Data  
0 Seq. is same as +ve Seq.

+ve Sequence R:	6961e-7 [pu/m]
+ve Sequence XL:	951e-6 [pu/m]
+ve Sequence XC:	571956 [pu/m]
0 Sequence R:	7.175e-6 [pu/m]
0 Sequence XL:	251e-5 [pu/m]
0 Sequence XC:	79396 [pu*m]

0 Seq. Z surge +ve Seq. Z surge Radio: 10.458

0 Seq. Trav. Time / +ve Seq. Trav. Time Radio: 1.532

Has the Entered Data Been Corrected for Long Line Effects? Yes

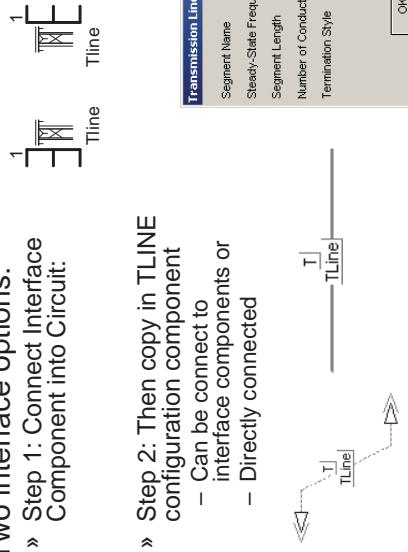
0 Seq. R +ve Seq. R Radio: 1.532

0 Seq. Trav. Time / +ve Seq. Trav. Time Radio: 1.532

OK Cancel Help...

30

# $U_I$ Distributed Parameter Line: EMTDC: Steps 1, 2 stay same

ECE 525  
Lecture 13

- Two interface options:
  - Step 1: Connect Interface Component into Circuit
  - Step 2: Then copy in TLINE configuration component
    - Can be connect to interface components or
    - Directly connected

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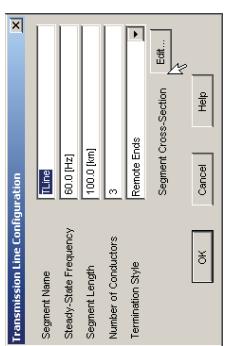
# $U_I$

## Distributed Parameter Line: EMTDC: Steps 3,4—stay same

# $U_I$

ECE 525  
Lecture 13

- Step 3: Next choose Edit:
- Step 4: Copy Line Model and Options Box from Master Library:
  - » In this case choose Bergeron (others later)



Bergeron Model Options  
Travel Time Interpolation: On  
Reflectionless Line (ie Infinite Length): No

Travel Time Interpolation: On

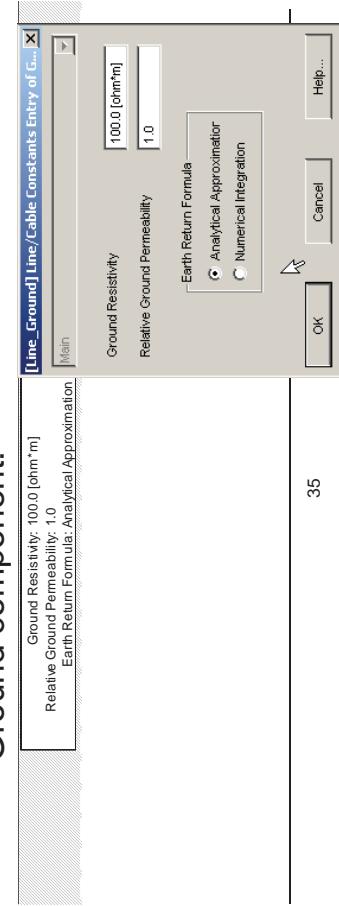
Reflectionless Line (ie Infinite Length): No

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# $U_I$

## Step 5 changes:

- Now select Ground Component and Required Tower Components
- » Ground component:

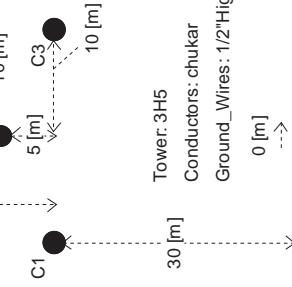


35



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- Copy tower components from master library.



Tower: 3H5  
Conductors: chukar  
Ground\_Wires: 1/2"HighStrengthSteel  
0 [m]  
-->

34

ECE 525  
Lecture 13

# $U_I$

## Step 5 changes:

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36

# U<sub>I</sub>

ECE 525  
Lecture 13

# U<sub>I</sub>

## Tower Data

**[Line\_Tower\_3\_Delta] Line Constants 3 Conductor Delta Tower**

Tower Data

Conductor Data

Ground Wire Data

Conductor Bundling X,Y Data

Phase/Node Connection Information

Tower Name	3H5
Height of Lowest Conductors (Meas. at Tower)	30 [m]
Vertical Distance of Centre Cond. Above Outer Cond.	5 [m]
Horiz. Spacing Between Phases	10 [m]
Relative X Position of Tower Centres on Right of Way	0 [m]
Shunt Conductance	1.0E-11 [mho/m]
Show Graphics of Cond. Seg?	<input checked="" type="radio"/> No <input type="radio"/> Yes
How Many Ground Wires?	<input checked="" type="radio"/> No <input type="radio"/> 1 <input type="radio"/> 2

Help...

OK Cancel Help...

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## Conductor Data

**[Line\_Tower\_3\_Delta] Line Constants 3 Conductor Delta Tower**

Tower Data

Conductor Data

Data Entry Method for Conductors

From Library  
 Custom

Conductor Name: chukar

Pathname of Cond. Lib.: C:\Home\user\ysc\cad\line\constants\database\

Conductor Radius: 0.0203454 [m]

Conductor DC Resistance: 0.03205 [ohm/m]

SAG for all Conductors: 10 [m]

Number of Sub-Conductors in a Bundle: 3

Bundle Configuration:  Symmetrical  
 Non-Symmetrical

Bundle Spacing: 4572 [m]

Show Bundle Graphics?  No  
 Yes

Ground Wire Name: 1/2"HighStrengthSteel

Pathname of Gnd Wire Lib: C:\Home\user\ysc\cad\line\constants\database\

Ground Wire Radius: 0.00525 [m]

Ground Wire DC Resistance: 2.8645 [ohm/m]

SAG for all Ground Wires: 10 [m]

Height of Ground Wires Above Lowest Conductor: 10 [m]

Spacing Between Ground Wires: 10 [m]

Help...

OK Cancel Help...

30 2018

# U<sub>I</sub> Universal Tower Geometry

ECE 525  
Lecture 13

# U<sub>I</sub> Universal Tower Geometry

ECE 525  
Lecture 13

- Alternate option:

Tower: 3H5

Conductors: chukar

Tower Centre 0 [m]

Ground\_Wires: 1/2"HighStrengthSteel

Connection X (from tower centre) Y (at tower)

GW. # Connection Phasing # (from tower centre) (at tower)

Cond. #	Connection Phasing #	X (from tower centre)	Y (at tower)	GW. #	Connection Phasing #	X (from tower centre)	Y (at tower)
1	1	-5 [m]	30 [m]	1	Eliminated	-2.5 [m]	40 [m]
2	2	0 [m]	30 [m]	2	Eliminated	2.5 [m]	40 [m]
3	3	5 [m]	30 [m]				

**[Line\_Tower\_Universal] Line Constants Manual Entry of XY Pos...**

Tower Data

Conductor Data

Conductor Coordinates

Ground Wire Data

Ground Wires Coordinates

Conductor Bundling X,Y Data

Conductor Bundling X,Y Data

Phase/Node Connection Information

Tower Name:	3H5
Relative X Position of Tower Centre on Right of Way:	0 [m]
Shunt Conductance:	1.0E-11 [mho/m]
Number of Conductors:	3
Show Graphics of Cond. Sag?	<input checked="" type="radio"/> No <input type="radio"/> Yes
Is this Circuit Ideally Transposed?	<input checked="" type="radio"/> No <input type="radio"/> Yes
How Many Ground Wires?	<input checked="" type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2
Eliminate Ground Wires?	<input checked="" type="radio"/> No <input type="radio"/> Yes

Help...

OK Cancel Help...

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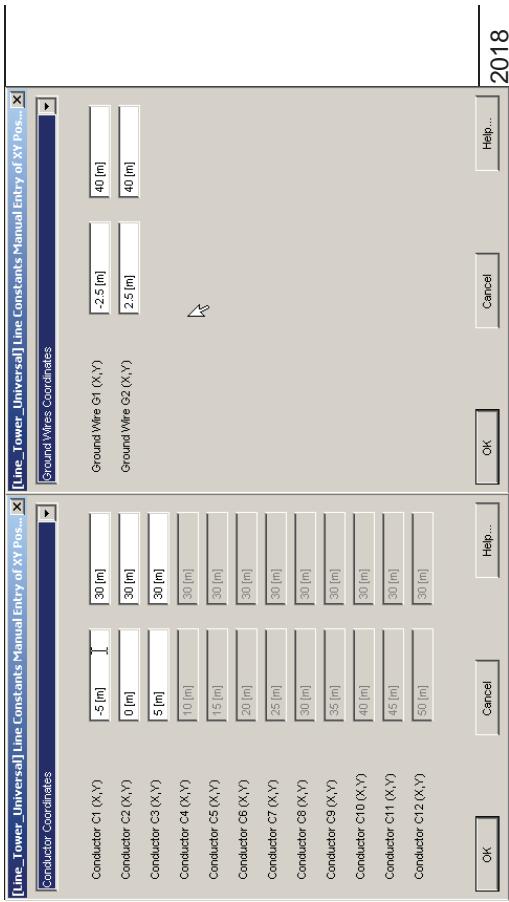
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# $U_I$ Conductor Coordinates

ECE 525  
Lecture 13

# $U_I$ Transformer Models

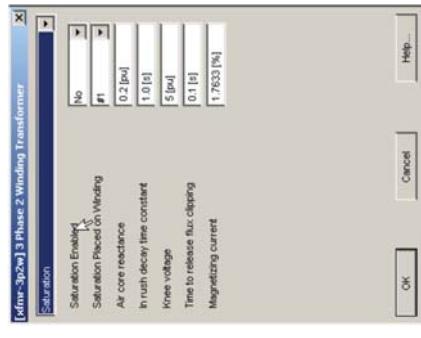
ECE 525  
Lecture 13



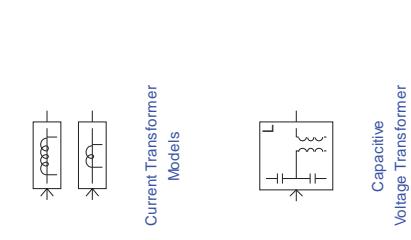
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# $U_I$ Transformer Models

ECE 525  
Lecture 13



ECE 525  
Lecture 13

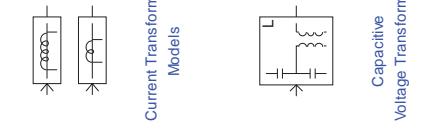


2 Current Transformers in Differential Configuration

Potential Transformer  
Capacitive Voltage Transformer

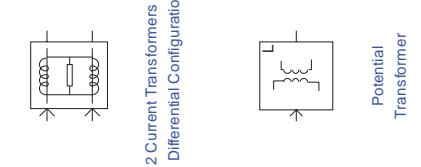
# $U_I$ CT and VT

ECE 525  
Lecture 13



ECE 525  
Lecture 13

ECE 525  
Lecture 13



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43

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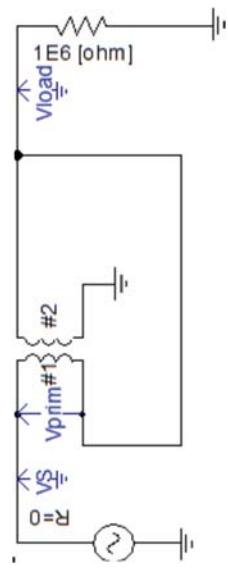
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44

# $U_I$

## Autotransformer

ECE 525  
Lecture 13



45

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