Power Line Systems

2019 PLS-CADD Advanced Training and User Group

Jumpers

by **Kevin Brzys Power Line Systems**



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IT'S THE SOLUTION

Introduction

- Overview of Jumpers
- Rules for modeling jumpers
- Loads from Jumpers
- Reasons to model Jumpers in PLS-CADD
- Examples

6/12/2019



Overview of Jumpers

- First added in version 14.50 (beta)
- Added in version 15.00 (production) of PLS-CADD
 - Date -8/31/2017

- Flexible or Rigid Jumpers can be modeled
 - Flexible jumpers are catenaries with no stiffness
 - Rigid jumpers are straight line segments with infinite stiffness



Rules for modeling jumpers

- To enable jumpers in PLS-CADD go to Criteria/ SAPS Finite
 Element Sag Tension and check the Jumper Options box at the bottom of the dialog.
- Cable properties of the back span are used for the jumper
- A jumper must begin and end on a dead-end section
- Suspension, 2-part and post insulators can be used as idler or jumper support insulators but strain or clamp insulators cannot be used for idlers.
- Only one jumper can connect to any given set:phase

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SAPS Finite Element Sag-Tension

- L3 Finite element analysis of system of (sag-tension computations will gen)
 - Level 3 options Limit level 3 modeling to PLS-P
- L4 Finite element analysis of system of (sag-tension computations could tag Level 4 options
 - Limit level 4 modeling to PLS-P
 Limit level 4 modeling to guyed
 Strip joints/members that don't
 Use Level 2 modeling for displa

Insulator Chaining Options

Include chained insulators in L2 and

This setting applies in situations where a suspension or 2 part insulator or swing b

L2 and L3 FE sag-tension models in PL9 flexibility or movement of other insulators

Newer versions of PLS-CADD can inclu and account for their movement.

Turn this feature on for the most accurations and sections sagged or clipped

L3 and L4 Options for Structure Loads –

Limit L3 and L4 structure modeling to Remaining structures will be modeled

Number of spans out to extend L3 having its loads computed)

Jumper Options

Include jumpers in FE sag-tension mo target section to target section plus u

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used when doing finite element sag-tension.
ection (no interaction between sections) or ruling span but still reasonably responsive) of sections interconnected by stiffness matrices nerally take a few seconds)
POLE structures, TOWER structures as level 2
of sections interconnected by full structure models ake many minutes and use large amounts of RAM depending on the model)
OLE structures, TOWER structures as level 3 or otherwise asymmetrical structures move significantly from level 4 TOWER models ay and insulator swing calculations
d L3 models (always included in L4)
a strain, suspension or 2-part insulator is suspended from the end of another bracket. It is provided in order to match results generated in earlier versions.
S-CADD 12.16 and earlier only include insulators that support wires. The rs that support these insulators is not accounted for (unless using L4).
ude these insulators that support other insulators in the FE model
ate model possible on any new projects. Turn it off for projects with chained bed in PLS-CADD 12.16 and earlier to match earlier tensions.
o structures within specified number of spans of structure having load computed. d L2.
4 structure modeling (0 if want only structure
nodel: Note that for L2 this can triple analysis time as model grows from single up to two sections it is jumpered to. Minimal impact on L3 and L4.
OK Cancel

4

Adding & Editing Jumpers

- Structure/Modify and Jumpers button
- Suctures/Jumpers and content menu have commands that include Add, Delete, Move, Copy, Paste, Edit and Graphical Sag of jumpers

Structure #71		Struct	ure Comment	s	_ ^		Set Counter	^
Line angle (deg) -23.00	1 71				_		Weight(lbs)	
deadend b 45.tow	2					1		_
	3					2		
Station (ft) 26799.922	4					3		
Height adjust. (ft) -4.560	5				-	4		-
Offset adjust. (ft) 0.000	6					5		-
Orientation (deg)	7					6		

Structu	ires	Sections	Lines	Drafting	Wi	ndow	Help		
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E	dit St	ructure				1			
С	ustor	mize Struct	ure	>		\sim			
S	nap B	lase or Legs	to TIN				1		
E	qualia	ze Tension					N.		

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		L.
Add XY Structure	Α	I
Add XY Structure along Line		l
Move XY Structure along Line		l
Modify Section	E	l
Table Edit	Т	l
Delete Section	D	l
Display Options For All Sections		l
Graphical Sag Section		l
Reverse Stringing Direction		l
Edit Cable File		l
Edit Jumper		l
Delete Jumper		l
Move Jumper		l
Copy/Paste Jumper		l
Graphical Sag Jumper		l
Section to Section Classes		l
Section to Section Clearance		l
Section to Structure Clearance		l
Section to Ground Centerline Clearance		l
Section to TIN Vertical Clearance		l
Section to TIN Minimum Clearance		l
Check		I
Sag-Tension		l
Stringing Chart		l
Offset Clipping		l
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Edit Circuit Connection		I
Set Circuit Labels		I
Define Circuit Labels		
Change Span Settings	c	
L DADDE SDAD SETTIDOE		- 20



Modeling flexible jumpers

Flexible Jumpers

- Defined with a sag or length
- wire attachment point used for suspension jumpers is the undeflected position
- wire attachment point used strain insulators is the deflected position at the wire stringing condition
- Idlers can be modeled from suspension, 2-part or post insulators
- Up to 7 intermediate points

Jumper Configuration

	Jumper	Jumper	Jumper	Imp	Imp	Imp	Imp	imp	Jumper	Jumper	Jumpe	Jumpe	Jumper	Jumper
	Туре	Connection	Connection	nec	nec	nec	nec	inec	Con. 1	Con. 2	Con. 3	Con. 4	Con. 5	Con. 6
		1	2		4	5	6	7	Sag (+)					
		Set:Phase	Set:Phase		:Pha	:Ph	::Pha	t:Pha	or	or	or	or	or	or
									Len (-)					
									(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
1	Flexible	5:1 Left Trans Ahead Sl-A	15:1 Left Trans Back S1-B						4.000					
2	Flexible	5:2 Left Trans Ahead S2-A	15:2 Left Trans Back S2-B						4.000					
3	Flexible	5:3 Left Trans Ahead S3-A	15:3 Left Trans Back S3-B						4.000					
4	Flexible	6:1 Right Trans Ahead S4-A	16:1 Right Trans Back S4-B						4.000					
5	Flexible	6:2 Right Trans Ahead S5-A	16:2 Right Trans Back S5-B						4.000					
6	Flexible	6:3 Right Trans Ahead S6-A	16:3 Right Trans Back S6-B						4.000					
7	Flexible	l:l Left SW Ahead Cl-A	ll:1 Left SW Back Cl-B						0.500					
8	Flexible	2:1 Right SW Ahead C2-A	12:1 Right SW Back C2-B						0.500					
~														



Modeling rigid jumpers

Rigid Jumpers

- Vertical or Horizontal options
- Defined with up to 7 intermediate points
- Insulators are defined by the shape in **Rigid Jumper Shape table**
 - X is the fraction of the chord . between the attachments
 - Y & Z defines the jumper in the • horizontal and vertical plane between the attachments.
- Post Insulators recommended for idlers
- Suspension and 2-part insulators not recommended for idlers because not part of FE analysis



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Jumper Type				Rigid	Horiz
er Connection 1 Set:Phase	21:1	IlA			
er Connection 2 Set:Phase	31:1	IlB			

#1 💌

х (fraction of chord (ft) (ft between 0 and 1) 0.125 0.659 0.250 0.866 0.375 0.965 0.500 1.001 0.625 0.965 0.750 0.866 0.875 0.659

OK Cancel

Loads from Jumpers

Flexible Jumpers

- Flexible jumpers are included in the FE Sag-Tension Model
- Rigid Jumpers
 - Not part of the FE Sag-Tension Analysis
 - Any loads from the rigid jumpers are added post analysis of the wire system



Why model Jumpers in PLS-CADD

- Material accountability
- Clearances To Ground or TIN
- Jumper to Structure Clearances
- Jumper to Wire Clearances
- Structure Loads from Jumpers
- Helps Define Circuits and Phases for use in
 - Sections/Electric/Simple Line Constants Calculator...
 - Sections/Electric/Full Line Constants Calculator...
 - Lines/Reports/Survey Point Clearances...
 - Other reports



Examples-Dead End Structures

#71 from WPL_example









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FAC 008/009 LiDAR Modeling CSA Distribution Line Optimization

GO95

Line Constant Calculations

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