SAMPLE
FEATools™ Model

Piping Translator Text Output

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Piping Translator Text Output
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 Version     : 16.0 Build. 2
 Date        : 4/22/2018 8:18:24 AM
 Input Name  : F:\Work\Support FEATools\Aquatech\SPURLOCK01-2.C2
 Output Name : F:\Work\Support FEATools\Aquatech\SPURLOCK01-2-FEA.C2

 PRG/CAESAR II - Enhanced Modeling of:
                 Branch, Vessel, Exchanger and Heater Nozzles
                 Bends with Trunions and Steel Supports
                 Pipe Shoes and Saddles

   Replace rigid branch connections with flexible models based on FEA.

   B31.1 is the code of choice. The MAX directional SIF will
   be used for ALL directions. SSIs are not used for B31.1.


   SIFS and ks are replaced with more applicable data on
   run and branch sides of std intersections.
   SSIs are not used for B31.1 (power) Codes.

   Treat all B16.9 tees with expected commercial commodity std wall.

   Torsional and axial SIFs included in FEA calculation and conversion.

   The axial SIF is used for pressure and axial loads
   and should be used with F/A and PD/4T for the nominal
   branch or run element framing into the intersection.
   The B31.3 Code uses ia for both pressure and axial loads
   even though these SIFs can be considerably different.
   For use with CAESAR the pressure SIF will be used for
   ia since it is considered the more critical of the SIFS.


   Attached lengths taken from CAESAR II piping model.

   Calculations in consistent English units

   Length = inches
   Force  = pounds
   Translate Stiffness = pound/inch
   Angular   Stiffness = inch-pound/degree

   Note: Some intersections and/or bends have not been processed since user
   defined SIFs have been specified at the intersection and/or bend node.
   This occurred at  28 location(s). The nodes where this occurred are:

   10, 30, 35, 40, 50, 70, 80, 110, 89, 165, 170, 290, 295, 315, 325, 330,
   319, 455, 460, 470, 480, 485, 550, 560, 720, 730, 1110, 1160
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*** NOTE ***

Could not identify run elements that comprise the intersection at the node = 180.
Please be sure that there are two colinear inlet pipes describing the run
and a properly oriented branch pipe.

Intersection Node = 140 Type = Pad Reinforced or Saddle

Run/Header Outside Diameter	=	30.000
Branch Outside Diameter	=	18.000
Run/Header Thickness	=	0.250
Branch Thickness	=	0.250
Pad Thickness	=	0.250
Pad Width	=	3.000
Total Branch Length	=	7.000
Fillet Leg Along Branch	=	0.250
Nozzle Angle (Degrees)	=	0.000
Modulus Used	=	28300000.
Run Length on fixed branch side	=	148.750
Run Length on free branch side	=	73.129
Branch Pipe Length	=	7.000

Branch Flexibility Factors (kax, kin, kout, ktor)
2.977 7.805 61.054 1.459

Header Flexibility Factors (kax, kin, kout, ktor) - ALL RIGID

	BRANCH SIFs			RUN/HEADER SIFs		
	B31.1	B31J	FEA	B31.1	B31J	FEA
In	5.484	5.094	6.787	5.484	3.964	1.619
Out	6.979	12.708	24.796	6.979	0.927	0.745
Tors	1.000	3.627	1.606	1.000	3.092	1.589
Axial	-	-	33.357	-	-	1.672
Press	-	-	6.485	-	-	3.869

	BRANCH SSIs			RUN/HEADER SSIs		
	B31.1	B31J	FEA	B31.1	B31J	FEA
In	4.113	1.720	1.892	4.113	1.582	1.174
Out	5.234	1.794	2.093	5.234	1.000	1.000
Tors	1.000	1.904	1.267	1.000	1.758	1.261
Axial	1.000	1.000	1.000	1.000	1.000	1.000
Press	1.000	1.000	1.537	1.000	1.000	1.365

	BRANCH Stiffnesses (Eff-Used)			RUN/HEADER Stiffnesses (Eff-Used)		
	B31.1	B31J	FEA	B31.1	B31J	FEA
Axial	RIGID	RIGID	315872.	RIGID	RIGID	RIGID
In	RIGID	1541763.	1957878.	RIGID	RIGID	RIGID
Out	RIGID	218169.	250279.	RIGID	RIGID	RIGID
Tors	RIGID	RIGID	10476213.	RIGID	RIGID	RIGID

Intersection Node = 520 Type = Pad Reinforced or Saddle

Run/Header Outside Diameter	=	20.000
Branch Outside Diameter	=	12.100
Run/Header Thickness	=	0.218
Branch Thickness	=	0.500
Pad Thickness	=	0.250
Pad Width	=	6.000
Total Branch Length	=	14.000
Nozzle Angle (Degrees)	=	0.000
Modulus Used	=	29800000.
Run Length on fixed branch side	=	98.910
Run Length on free branch side	=	35.875
Branch Pipe Length	=	14.000

Branch Flexibility Factors (kax, kin, kout, ktor)
3.336 9.785 62.178 2.062

Header Flexibility Factors (kax, kin, kout, ktor) - ALL RIGID

	BRANCH SIFs			RUN/HEADER SIFs		
	B31.1	B31J	FEA	B31.1	B31J	FEA
In	12.337	6.818	13.128	5.379	2.566	0.997
Out	12.337	12.476	13.128	5.379	0.537	0.997
Tors	12.337	7.402	13.128	5.379	1.675	0.997
Axial	-	-	22.086	-	-	1.040
Press	-	-	9.062	-	-	2.317

	BRANCH Stiffnesses (Eff-Used)			RUN/HEADER Stiffnesses (Eff-Used)		
	B31.1	B31J	FEA	B31.1	B31J	FEA
Axial	RIGID	RIGID	468982.	RIGID	RIGID	RIGID
In	RIGID	1264887.	1392829.	RIGID	RIGID	RIGID
Out	RIGID	190558.	219182.	RIGID	RIGID	RIGID
Tors	RIGID	7455094.	6610088.	RIGID	RIGID	RIGID

Intersection Node = 760 Type = Pad Reinforced or Saddle

Run/Header Outside Diameter	=	18.000
Branch Outside Diameter	=	12.100
Run/Header Thickness	=	0.188
Branch Thickness	=	0.250
Pad Thickness	=	0.250
Pad Width	=	6.000
Total Branch Length	=	13.062
Nozzle Angle (Degrees)	=	0.000
Modulus Used	=	29800000.
Run Length on fixed branch side	=	89.060
Run Length on free branch side	=	49.812
Branch Pipe Length	=	13.062

Branch Flexibility Factors (kax, kin, kout, ktor)
2.520 6.097 34.092 1.952

Header Flexibility Factors (kax, kin, kout, ktor) - ALL RIGID

	BRANCH SIFs			RUN/HEADER SIFs		
	B31.1	B31J	FEA	B31.1	B31J	FEA
In	6.700	4.901	14.098	5.038	3.286	1.323
Out	6.700	10.287	14.098	5.038	0.877	1.323
Tors	6.700	4.805	14.098	5.038	2.568	1.323
Axial	-	-	19.409	-	-	1.438
Press	-	-	6.862	-	-	3.433

	BRANCH Stiffnesses (Eff-Used)			RUN/HEADER Stiffnesses (Eff-Used)		
	B31.1	B31J	FEA	B31.1	B31J	FEA
Axial	RIGID	RIGID	543092.	RIGID	RIGID	RIGID
In	RIGID	991473.	1164687.	RIGID	RIGID	RIGID
Out	RIGID	155948.	208287.	RIGID	RIGID	RIGID
Tors	RIGID	6188607.	3638564.	RIGID	RIGID	RIGID

Intersection Node = 850 Type = Pad Reinforced or Saddle

Run/Header Outside Diameter	=	18.000
Branch Outside Diameter	=	10.750
Run/Header Thickness	=	0.188
Branch Thickness	=	0.365
Pad Thickness	=	0.250
Pad Width	=	2.000
Total Branch Length	=	10.500

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Fillet Leg Along Branch          =        0.250
Fillet Leg Along Vessel          =        0.250

Note: Parent Metal Inside Nozzle NOT Removed

Nozzle Angle (Degrees)           =        0.000
Modulus Used                     =     29800000.

Run Lengths on each branch side  =       89.060
Branch Pipe Length               =       10.500

Branch Flexibility Factors (kax, kin, kout, ktor)
    3.623     9.416    92.959     1.496

Header Flexibility Factors (kax, kin, kout, ktor) - ALL RIGID
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	BRANCH SIFs			RUN/HEADER SIFs		
	B31.1	B31J	FEA	B31.1	B31J	FEA
In	7.822	6.238	4.416	4.029	2.691	1.197
Out	9.782	11.088	24.929	5.038	0.609	0.696
Tors	1.000	6.302	1.314	1.000	1.863	0.945
Axial	-	-	33.890	-	-	1.184
Press	-	-	8.602	-	-	2.583

	BRANCH SSIs			RUN/HEADER SSIs		
	B31.1	B31J	FEA	B31.1	B31J	FEA
In	4.400	3.572	3.184	3.022	1.390	1.062
Out	5.502	3.376	4.068	3.779	1.000	1.000
Tors	1.092	4.874	2.225	1.000	1.365	1.000
Axial	1.456	1.000	1.000	1.000	1.000	1.000
Press	1.000	5.921	3.185	1.000	1.000	1.244

	BRANCH Stiffnesses (Eff-Used)			RUN/HEADER Stiffnesses (Eff-Used)		
	B31.1	B31J	FEA	B31.1	B31J	FEA
Axial	RIGID	RIGID	267112.	RIGID	RIGID	RIGID
In	RIGID	822051.	846339.	RIGID	RIGID	RIGID
Out	RIGID	127439.	85723.	RIGID	RIGID	RIGID
Tors	RIGID	4992004.	5325834.	RIGID	RIGID	RIGID

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    *** NOTE *** At the vessel/nozzle node   1110:
    The geometry on a pipe element in the model is not appropriately defined as a branch/
nozzle.
    Please check the model in the vicinity of this node for the configuration needed to
define the
    vessel/exchanger nozzle connection. Vessel Nozzles connect to the surface of the
    vessel or exchanger. Pipe intersection nodes connect at the centerline of the branch
and run.


    *** NOTE *** At the vessel/nozzle node   1160:
    The geometry on a pipe element in the model is not appropriately defined as a branch/
nozzle.
    Please check the model in the vicinity of this node for the configuration needed to
define the
    vessel/exchanger nozzle connection. Vessel Nozzles connect to the surface of the
    vessel or exchanger. Pipe intersection nodes connect at the centerline of the branch
and run.


    *** NOTE *** At the vessel/nozzle node   1230:
    The geometry on a pipe element in the model is not appropriately defined as a branch/
nozzle.

    Please check the model in the vicinity of this node for the configuration needed to
define the
    vessel/exchanger nozzle connection. Vessel Nozzles connect to the surface of the
    vessel or exchanger. Pipe intersection nodes connect at the centerline of the branch
and run.


    Number of Standard Pipe Intersections Detected =           6
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Where i-factors are less than 1.0 a value of 1.0 is used.
Where k-factors are less than 1.0, a rigid stiffness is
used for that branch stiffness for that direction.

Node	Intersection Type	Els Attch	Brch Angle	Branch OD	Branch Thk	Run/Header OD	Run/Header Thk	STATUS	Notes
140	Pad Reinforced	3	90	18.000	0.250	30.000	0.250	Processed	1,2
520	Pad Reinforced	3	90	12.100	0.500	20.000	0.218	Processed	
760	Pad Reinforced	3	90	12.100	0.250	18.000	0.188	Processed	
850	Pad Reinforced	3	90	10.750	0.365	18.000	0.188	Processed	2

Notes:

1)Branch inplane/outplane directions switched for SIF/SSI description.
2)Run inplane/outplane directions switched for SIF/SSI description.

Intersection Parameters

Node	D/T	d/D	d/t	lambda	SIF	psi Pressure	N(Markl)	N(PRG)
140	119.000	0.597	71.000	6.509	3.869	4.500	2x10^13	5x10^9
520	90.743	0.586	23.200	5.586	2.317	16.500	2x10^12	1x10^9
760	94.745	0.665	47.400	6.476	3.433	45.200	1x10^9	2x10^7
850	94.745	0.583	28.452	5.675	2.583	11.200	6x10^12	2x10^9

N(Markl) = Number of pressure cycles allowed (SF=2 on Stress) using S = 490N^-0.2; ksi,range
N(PRG) = Number of pressure cycles allowed (SF=2 on Stress) using S = 1895N^-0.335; ksi,range

D/T Max 119.0
d/D Max 0.665
d/D Min 0.583

Have branches in range: 0.65 < d/D < 0.85

Users lowest cyclic reduction factor = 1.000000

Restraint Nodes Node	Type	RUN #1 Node	RUN #1 CNode	RUN #2 Node	RUN #2 CNode	BRANCH Node	BRANCH CNode
140	Pad Reinforced	141	140	142	140	144	143
520	Pad Reinforced	521	520	522	520	524	523
760	Pad Reinforced	761	760	762	760	764	763
850	Pad Reinforced	851	850	852	850	856	853

Modified Junction Elements

Junction	/----- Original	At Junc ----//----------	New	At Junc --------/
140	115 to 140 at 140		115 to 141 at 141	
	140 to 165 at 140		142 to 165 at 142	
	140 to 155 at 140		155 to 144 to 143 to 140	
520	510 to 520 at 520		510 to 521 at 521	
	520 to 530 at 520		522 to 530 at 522	
	520 to 525 at 520		525 to 524 to 523 to 520	
760	750 to 760 at 760		750 to 761 at 761	
	760 to 790 at 760		762 to 790 at 762	
	760 to 765 at 760		765 to 764 to 763 to 760	
850	830 to 850 at 850		830 to 851 at 851	
	850 to 870 at 850		852 to 870 at 852	
	850 to 854 at 850		854 to 856 to 853 to 850	

Intersection Modification Processing Completed.

*** DETAILED BEND REPORT ***

Bend TIPT = 90
Bend Ftg OD = 30.000 in. Bend Ftg Thk = 0.250 in.
Bend Radius = 45.000 in. Bend Angle = 90.000 deg
Miter Cuts = 5 Num Trunions = 1
Bend Weld Length= 0.250 in. Trunion Weld Len= 0.250 in.
Weld SCF = 1.350 Trunion OD = 16.000 in.
Trunion Thick = 0.188 in. Trunion Length = 63.375 in.
Enough Str Pipe In/Out no BC Effect Bend ATTACHMENT is Present

Method	Bend (ii)	Bend (io)	Bend (ki)	Bend (ko)	TRUN (ii)	TRUN (io)	TRUN (ki)	TRUN (ko)
B31.3 No Flanged Ends	5.78	4.82	15.54	15.54	1.00	1.00	1.00	1.00
B31.3 Single Flanged	3.52	2.93	9.46	9.46	...	...	...	...
B31.3 Double Flanged	2.14	1.78	5.76	5.76	...	...	...	...
EPRI Adjusted Data	3.36	3.37	13.85	3.14	1.20	1.01	1.00	1.00
B31J Adjusted Data	7.22	7.22	13.65	13.46	2.85	4.60	1.00	1.00
N319-3 Adjusted Data	7.22	3.37	12.24	24.24	2.85	4.60	1.00	1.00
Return HyperDOF values	8.46	4.28	29.11	26.53	3.24	5.22	1.00	1.00

Bend TIPT = 95
Bend Ftg OD = 30.000 in. Bend Ftg Thk = 0.250 in.
Bend Radius = 45.000 in. Bend Angle = 45.000 deg
Miter Cuts = 3 BC Removal Len = 152.706 in.
Str Length in = 22.700 in. Str Length out = 88.000 in.
Attached Lengths will affect bend

Method	Bend (ii)	Bend (io)	Bend (ki)	Bend (ko)
B31.3 No Flanged Ends	5.19	4.32	13.58	13.58
B31.3 Single Flanged	3.16	2.63	8.27	8.27
B31.3 Double Flanged	1.92	1.60	5.03	5.03
EPRI Adjusted Data	4.66	3.03	9.05	10.29
B31J Adjusted Data	5.19	5.19	11.93	11.93
N319-3 Adjusted Data	4.66	3.03	9.05	24.59
Return HyperDOF values	2.35	2.47	8.27	7.93

Bend TIPT = 300
Bend Ftg OD = 30.000 in. Bend Ftg Thk = 0.250 in.
Bend Radius = 45.000 in. Bend Angle = 90.000 deg
Num of Flgs = 1 Miter Cuts = 5
OD Pipe (in) = 20.000 in. OD Pipe (out) = 30.000 in.
Thk Pipe (in) = 0.250 in. Thk Pipe (out) = 0.250 in.
BC Removal Len = 152.706 in. Str Length in = 0.382 in.
Str Length out = 152.706 in. Do NOT have Matching Pipe
Attached Lengths will affect bend

Method	Bend (ii)	Bend (io)	Bend (ki)	Bend (ko)
B31.3 No Flanged Ends	5.78	4.82	15.54	15.54
B31.3 Single Flanged	3.52	2.93	9.46	9.46
B31.3 Double Flanged	2.14	1.78	5.76	5.76
EPRI Adjusted Data	3.52	2.05	7.45	7.16
B31J Adjusted Data	3.52	3.52	8.31	8.31
N319-3 Adjusted Data	3.52	2.05	7.45	14.96
Return HyperDOF values	1.45	0.93	13.27	6.44

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    Bend TIPT       =          310
    Bend Ftg OD     =       30.000 in.     Bend Ftg Thk    =        0.250 in.
    Bend Radius     =       45.000 in.     Bend Angle      =       90.000 deg
    Miter Cuts      =            5         BC Removal Len  =      152.706 in.
    Str Length in   =       72.350 in.     Str Length out  =       32.000 in.
    Attached Lengths will affect bend

                                Bend    Bend    Bend    Bend
    Method                      (ii)    (io)    (ki)    (ko)
    B31.3 No Flanged Ends       5.78    4.82   15.54   15.54
    B31.3 Single Flanged        3.52    2.93    9.46    9.46
    B31.3 Double Flanged        2.14    1.78    5.76    5.76
    EPRI Adjusted Data          5.78    3.37   12.24   11.77
    B31J Adjusted Data          5.78    5.78   13.65   13.65
    N319-3 Adjusted Data        5.78    3.37   12.24   24.59
    Return HyperDOF values      5.01    3.81   19.74   21.00
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    Bend TIPT       =          320
    Bend Ftg OD     =       30.000 in.     Bend Ftg Thk    =        0.250 in.
    Bend Radius     =       45.000 in.     Bend Angle      =       90.000 deg
    Miter Cuts      =            5         BC Removal Len  =      152.706 in.
    Str Length in   =       32.000 in.     Str Length out  =       24.000 in.
    Num Trunions    =            1         Bend Weld Length=        0.250 in.
    Trunion Weld Len=        0.250 in.     Weld SCF        =        1.350
    Trunion OD      =       16.000 in.     Trunion Thick   =        0.188 in.
    Trunion Length  =       63.375 in.     Attached Lengths will affect bend
    Bend ATTACHMENT is Present

                                Bend    Bend    Bend    Bend    TRUN    TRUN    TRUN
TRUN
    Method                      (ii)    (io)    (ki)    (ko)    (ii)    (io)    (ki)
(ko)
    B31.3 No Flanged Ends       5.78    4.82   15.54   15.54    1.00    1.00    1.00
1.00
    B31.3 Single Flanged        3.52    2.93    9.46
9.46     ...     ...     ...     ...
    B31.3 Double Flanged        2.14    1.78    5.76
5.76     ...     ...     ...     ...
    EPRI Adjusted Data          3.36    3.37   13.85    3.14    1.20    1.01    1.00
1.00
    B31J Adjusted Data          7.22    7.22   13.65   13.46    2.85    4.60    1.00
1.00
    N319-3 Adjusted Data        7.22    3.37   12.24   24.24    2.85    4.60    1.00
1.00
    Return HyperDOF values      3.66    2.70   12.26   11.64    3.24    5.22    1.00
1.00
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    Bend TIPT       =          465
    Bend Ftg OD     =       24.000 in.     Bend Ftg Thk    =        0.250 in.
    Bend Radius     =       36.000 in.     Bend Angle      =       90.000 deg
    OD Pipe (in)    =       20.000 in.     OD Pipe (out)   =       24.000 in.
    Thk Pipe (in)   =        0.250 in.     Thk Pipe (out)  =        0.250 in.
    BC Removal Len  =      111.733 in.     Str Length in   =       24.000 in.
    Str Length out  =       57.000 in.     Do NOT have Matching Pipe
    Attached Lengths will affect bend

                                Bend    Bend    Bend    Bend
    Method                      (ii)    (io)    (ki)    (ko)
    B31.3 No Flanged Ends       5.64    4.70   25.85   25.85
    B31.3 Single Flanged        3.56    2.97   16.34   16.34
    B31.3 Double Flanged        2.25    1.88   10.33   10.33
    EPRI Adjusted Data          5.63    3.39   20.37   19.59
    B31J Adjusted Data          5.64    4.70   22.72   22.72
    N319-3 Adjusted Data        5.63    3.39   20.37   19.59
    Return HyperDOF values      2.69    2.05   17.40   13.69
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    Bend TIPT       =          475
    Bend Ftg OD     =       24.000 in.     Bend Ftg Thk    =        0.250 in.
    Bend Radius     =       36.000 in.     Bend Angle      =       90.000 deg
    Num Trunions    =            1         Bend Weld Length=        0.250 in.
    Trunion Weld Len=        0.250 in.     Weld SCF        =        1.350
    Trunion OD      =       12.750 in.     Trunion Thick   =        0.180 in.
    Trunion Length  =       24.000 in.     Enough Str Pipe In/Out no BC Effect
    Bend ATTACHMENT is Present

                                Bend    Bend    Bend    Bend    TRUN    TRUN    TRUN
TRUN
    Method                      (ii)    (io)    (ki)    (ko)    (ii)    (io)    (ki)
(ko)
    B31.3 No Flanged Ends       5.64    4.70   25.85   25.85    1.00    1.00    1.00
1.00
    B31.3 Single Flanged        3.56    2.97   16.34
16.34     ...     ...     ...     ...
    B31.3 Double Flanged        2.25    1.88   10.33
10.33     ...     ...     ...     ...
    EPRI Adjusted Data          3.32    3.39   22.57    5.35    1.18    1.00    1.00
1.00
    B31J Adjusted Data          7.00    4.70   22.72   22.43    2.64    4.49    1.00
1.00
    N319-3 Adjusted Data        7.00    3.39   20.37   19.33    2.64    4.49    1.00
1.00
    Return HyperDOF values      7.27    3.80   23.14   21.09    2.64    4.49    1.00
1.00
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    Bend TIPT       =          490
    Bend Ftg OD     =       24.000 in.     Bend Ftg Thk    =        0.250 in.
    Bend Radius     =       36.000 in.     Bend Angle      =       90.000 deg
    Num of Flgs     =            1         BC Removal Len  =      111.733 in.
    Str Length in   =      111.733 in.     Str Length out  =        0.279 in.

    Attached Lengths will affect bend

                                Bend    Bend    Bend    Bend
    Method                      (ii)    (io)    (ki)    (ko)
    B31.3 No Flanged Ends       5.64    4.70   25.85   25.85
    B31.3 Single Flanged        3.56    2.97   16.34   16.34
    B31.3 Double Flanged        2.25    1.88   10.33   10.33
    EPRI Adjusted Data          3.56    2.14   12.88   12.38
    B31J Adjusted Data          3.56    2.97   14.36   14.36
    N319-3 Adjusted Data        3.56    2.14   12.88   12.38
    Return HyperDOF values      4.29    3.98   11.25   14.78
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    Bend TIPT       =          750
    Bend Ftg OD     =       18.000 in.     Bend Ftg Thk    =        0.188 in.
    Bend Radius     =       27.000 in.     Bend Angle      =       90.000 deg
    Num of Flgs     =            1         BC Removal Len  =       83.710 in.
    Str Length in   =       83.710 in.     Str Length out  =        0.209 in.
    Attached Lengths will affect bend

                                Bend    Bend    Bend    Bend
    Method                      (ii)    (io)    (ki)    (ko)
    B31.3 No Flanged Ends       5.63    4.69   25.78   25.78
    B31.3 Single Flanged        3.56    2.96   16.31   16.31
    B31.3 Double Flanged        2.25    1.88   10.31   10.31
    EPRI Adjusted Data          3.56    2.14   12.85   12.35
    B31J Adjusted Data          3.56    2.96   14.33   14.33
    N319-3 Adjusted Data        3.56    2.14   12.85   12.35
    Return HyperDOF values      4.29    4.01   11.32   14.87
-------------------------------------------------------------------------------------------

    Bend TIPT       =          790
    Bend Ftg OD     =       18.000 in.     Bend Ftg Thk    =        0.188 in.
    Bend Radius     =       27.000 in.     Bend Angle      =       90.000 deg
    Enough Str Pipe In/Out no BC Effect
```

Method	Bend (ii)	Bend (io)	Bend (ki)	Bend (ko)
B31.3 No Flanged Ends	5.63	4.69	25.78	25.78
B31.3 Single Flanged	3.56	2.96	16.31	16.31
B31.3 Double Flanged	2.25	1.88	10.31	10.31
EPRI Adjusted Data	5.62	3.39	20.31	19.53
B31J Adjusted Data	5.63	4.69	22.66	22.66
N319-3 Adjusted Data	5.62	3.39	20.31	19.53
Return HyperDOF values	5.81	3.84	23.31	21.53

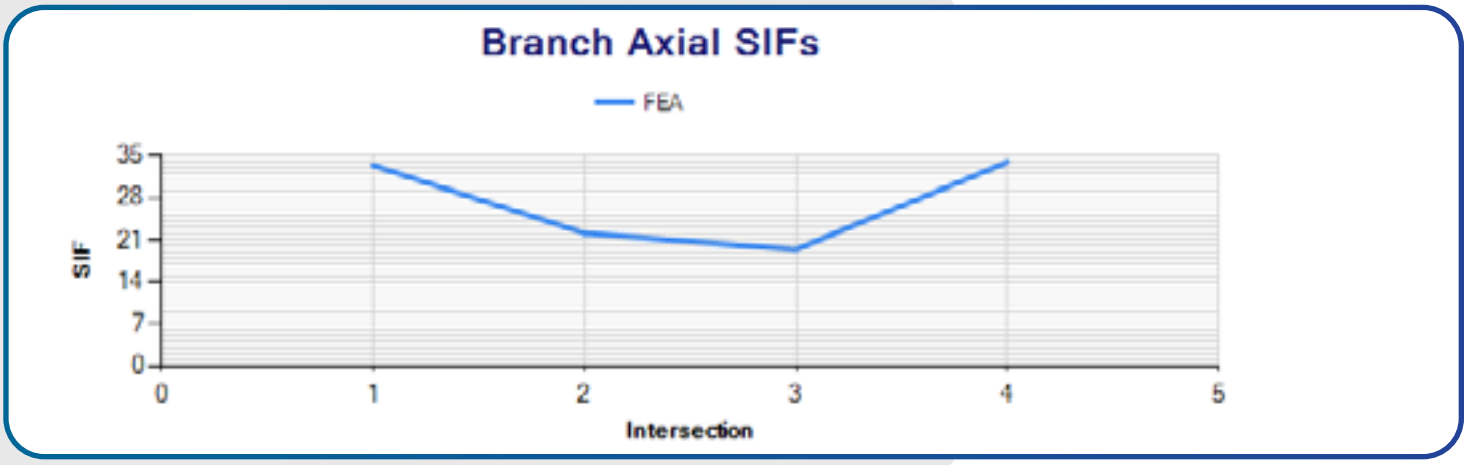
Bend TIPT =	870		
Bend Ftg OD =	18.000 in.	Bend Ftg Thk =	0.188 in.
Bend Radius =	27.000 in.	Bend Angle =	90.000 deg
Num of Flgs =	1	BC Removal Len =	83.710 in.
Str Length in =	72.625 in.	Str Length out =	0.209 in.

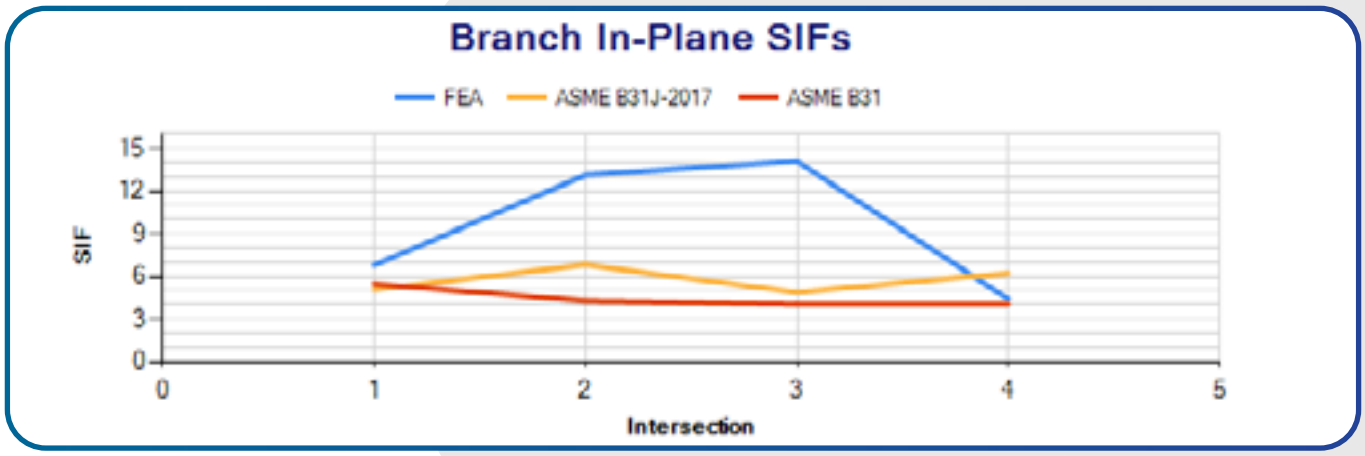
Attached Lengths will affect bend

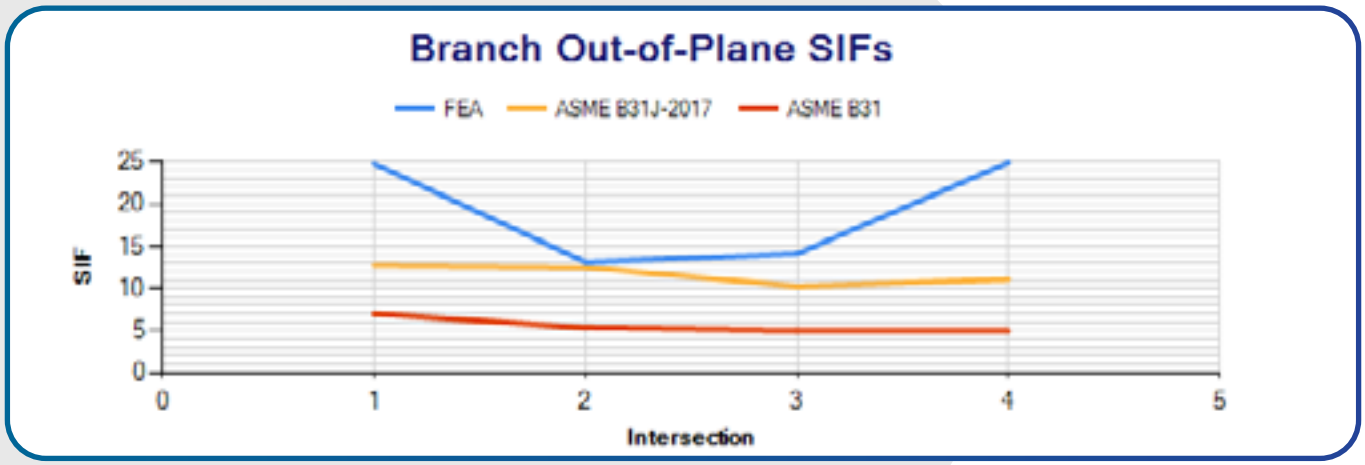
Method	Bend (ii)	Bend (io)	Bend (ki)	Bend (ko)
B31.3 No Flanged Ends	5.63	4.69	25.78	25.78
B31.3 Single Flanged	3.56	2.96	16.31	16.31
B31.3 Double Flanged	2.25	1.88	10.31	10.31
EPRI Adjusted Data	3.56	2.14	12.85	12.35
B31J Adjusted Data	3.56	2.96	14.33	14.33
N319-3 Adjusted Data	3.56	2.14	12.85	12.35
Return HyperDOF values	4.28	4.00	11.20	14.67

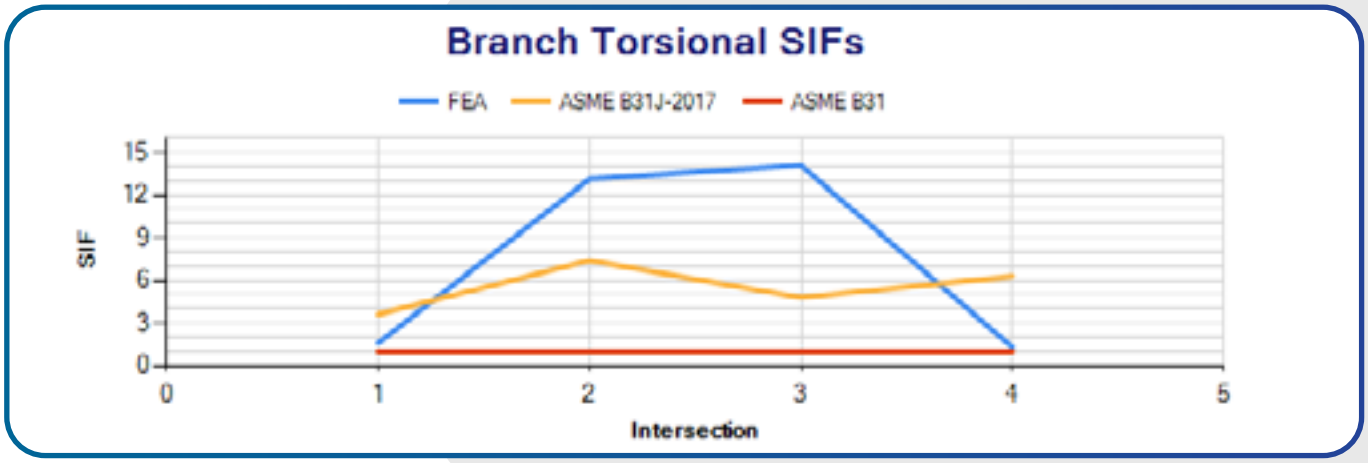
Bend TIPT =	1030		
Bend Ftg OD =	20.000 in.	Bend Ftg Thk =	0.375 in.
Bend Radius =	30.000 in.	Bend Angle =	90.000 deg
Num of Flgs =	2	Miter Cuts =	5
BC Removal Len =	73.602 in.	Str Length in =	0.184 in.
Str Length out =	0.184 in.	Attached Lengths will affect bend	

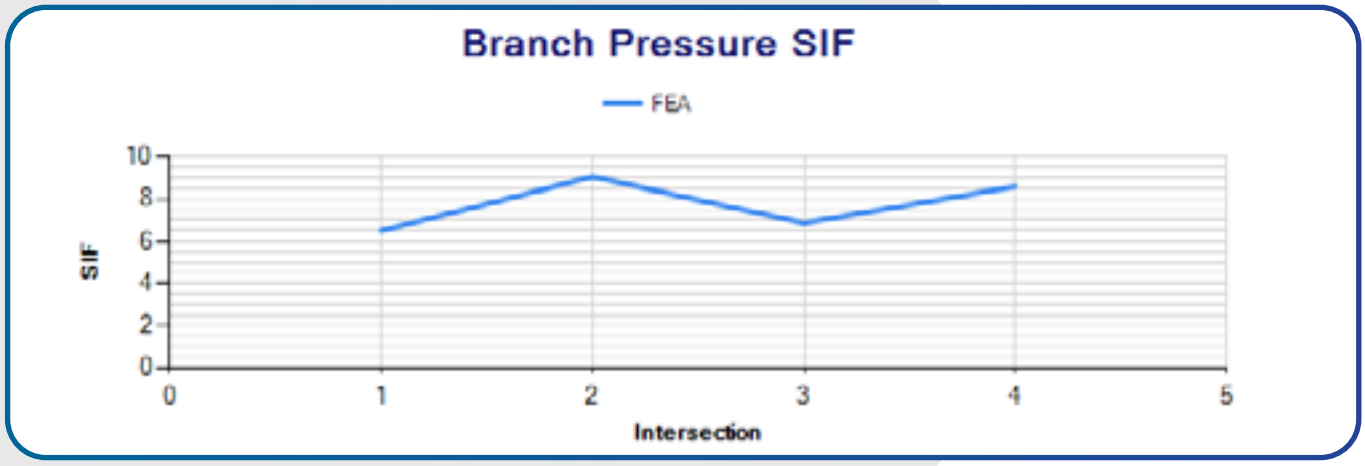
Method	Bend (ii)	Bend (io)	Bend (ki)	Bend (ko)
B31.3 No Flanged Ends	3.34	2.78	7.84	7.84
B31.3 Single Flanged	2.34	1.95	5.48	5.48
B31.3 Double Flanged	1.63	1.36	3.83	3.83
EPRI Adjusted Data	1.63	1.07	3.02	2.90
B31J Adjusted Data	1.63	1.63	3.37	3.37
N319-3 Adjusted Data	1.63	1.07	3.02	5.23
Return HyperDOF values	2.13	1.95	2.79	2.58

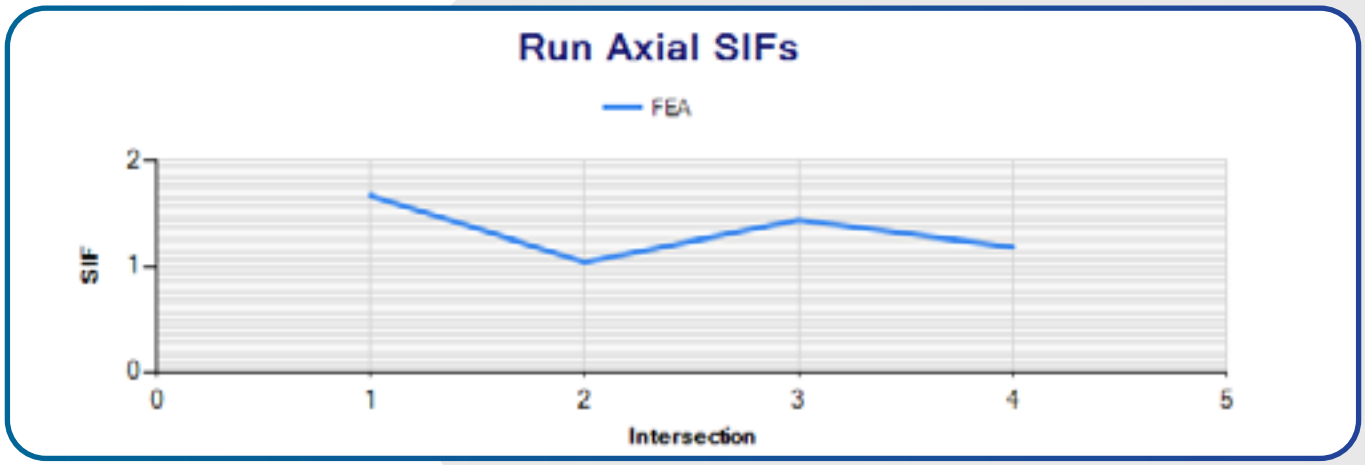


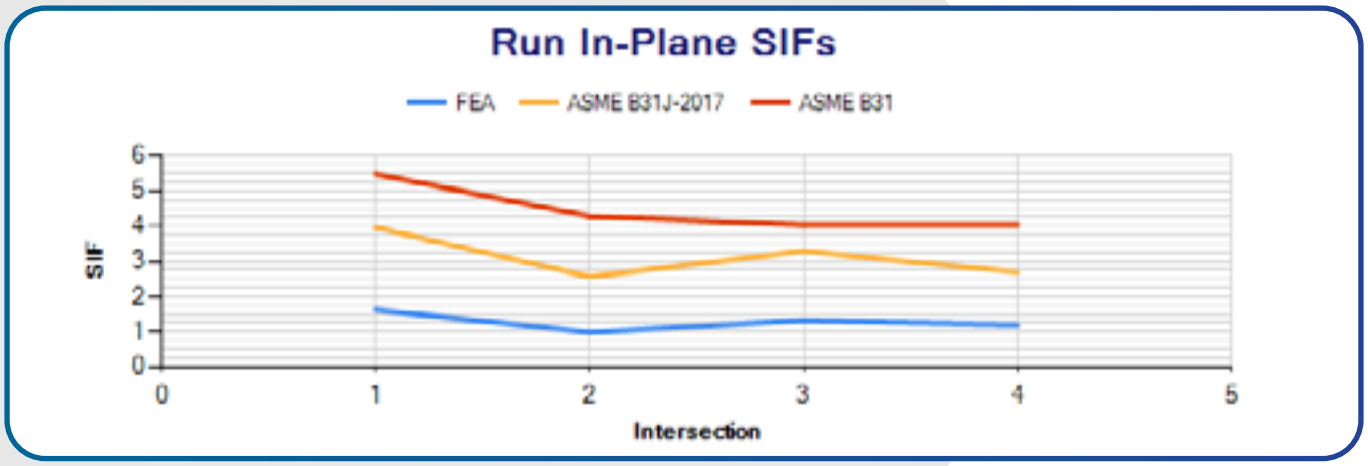

Branch In-Plane SIFs
FEA
ASME B31J-2017
ASME B31
SIF
15
12
9
6
3
0
0
1
2
3
4
5
Intersection

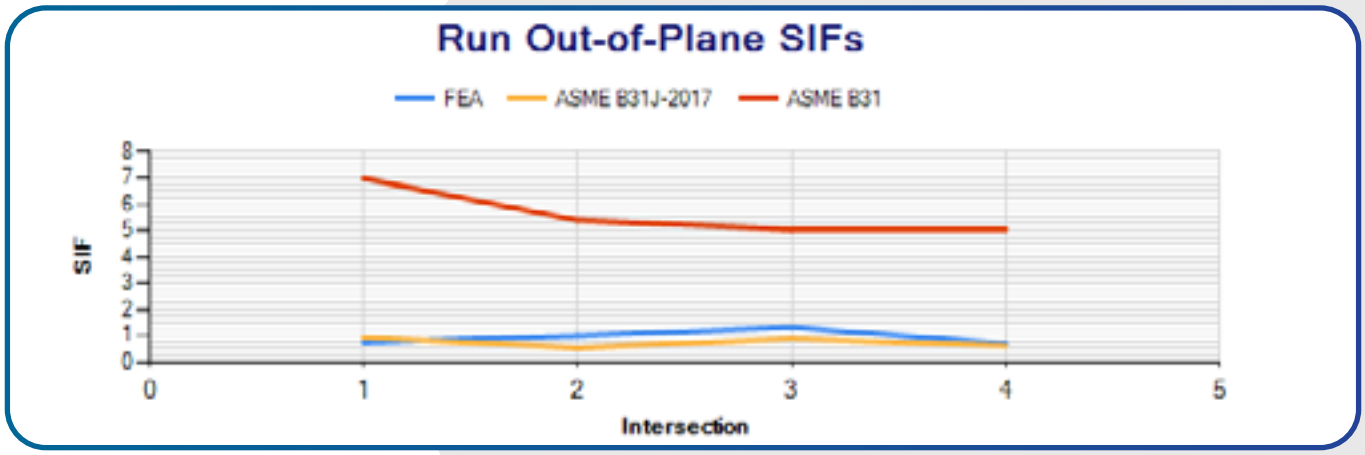

Branch Out-of-Plane SIFs
FEA
ASME B31J-2017
ASME B31
SIF
25
20
15
10
5
0
0
1
2
3
4
5
Intersection

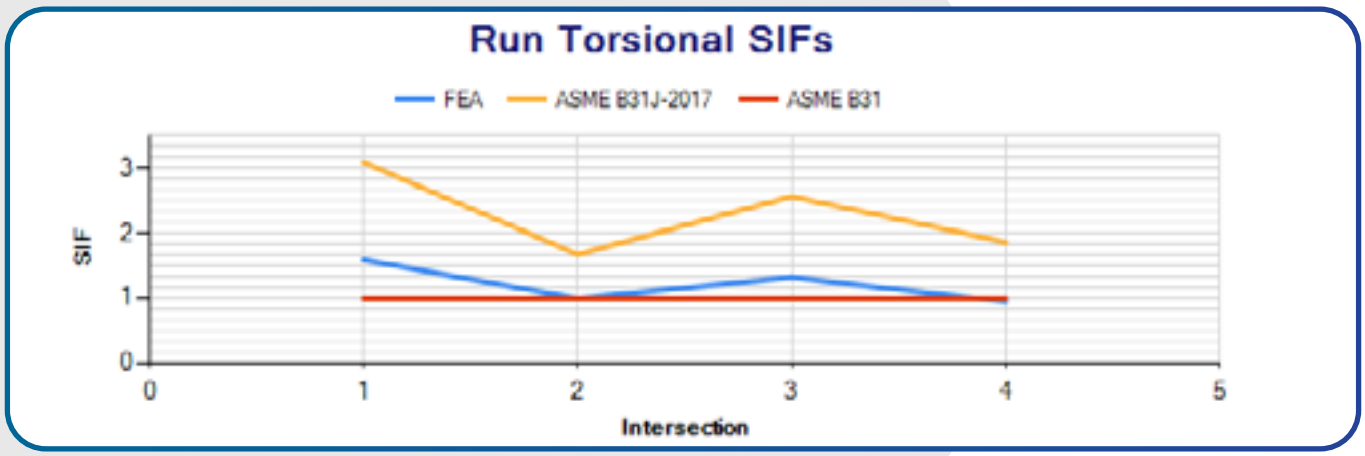

Branch Torsional SIFs
FEA
ASME B31J-2017
ASME B31
SIF
15
12
9
6
3
0
0
1
2
3
4
5
Intersection

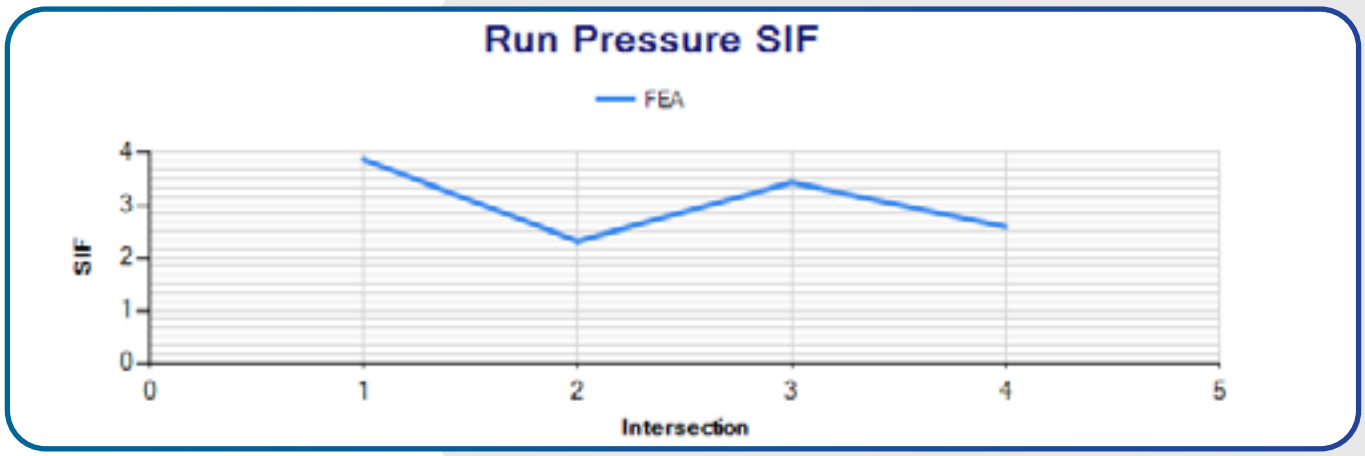

Branch Pressure SIF
FEA
SIF
10
8
6
4
2
0
0
1
2
3
4
5
Intersection

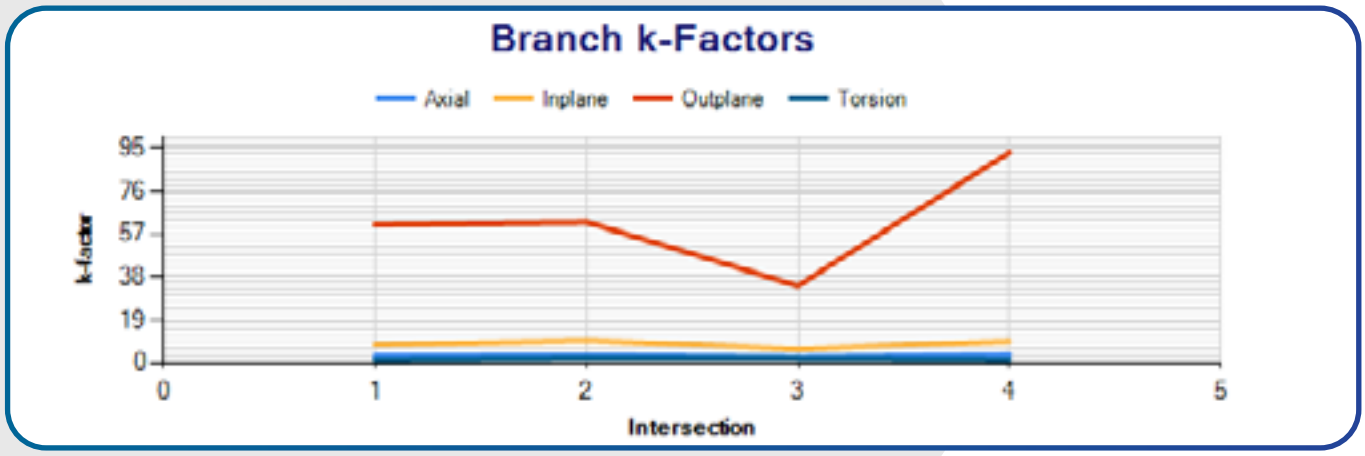

Run Axial SIFs
FEA
SIF
2
1
0
0
1
2
3
4
5
Intersection

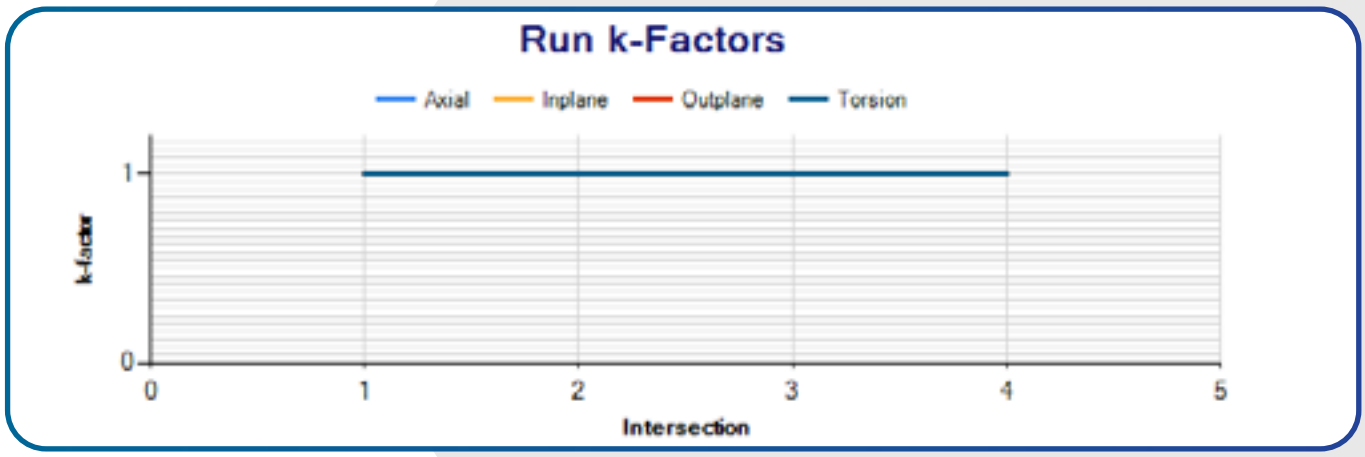

Run In-Plane SIFs
FEA
ASME B31J-2017
ASME B31
SIF
6
5
4
3
2
1
0
0
1
2
3
4
5
Intersection


Run Out-of-Plane SIFs
FEA
ASME B31J-2017
ASME B31
SIF
0
1
2
3
4
5
6
7
8
0
1
2
3
4
5
Intersection


Run Torsional SIFs
FEA
ASME B31J-2017
ASME B31
SIF
0
1
2
3
0
1
2
3
4
5
Intersection


Run Pressure SIF
FEA
SIF
0
1
2
3
4
0
1
2
3
4
5
Intersection


Branch k-Factors
Axial
Inplane
Outplane
Torsion
95
76
57
38
19
0
k-factor
0
1
2
3
4
5
Intersection


Run k-Factors
Axial
Inplane
Outplane
Torsion
1
0
k-factor
0
1
2
3
4
5
Intersection