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UNIVERSITAT POLITÈCNICA DE CATALUNYA

Volumen III

Anexos

TRABAJO DE FINAL DE GRADO

“Simulación CFD sistema de combustible Dual-Fuel en MCI (Motor Combustión Interna)”

TFG presentado para optar al título de GRADO en
INGIENERÍA MECÁNICA
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1. Simulación de las tuberías

Informes y gráficos de cada bloque:

Bloque 1:

TEA Pipe.1

| | Geometrical Curve Radius | Torsion Angle (per unit of length) |
|----------------|--------------------------|------------------------------------|
| Initialisation | $1e+102 > 30$ (mm) | $0 < +100$ (deg/m) |
| Mounting | $182.432 > 30$ (mm) | $0.00208158 < +100$ (deg/m) |
| Overall | $182.432 > 30$ (mm) | $0.00208158 < +100$ (deg/m) |

TEA Pipe.1

Status of Computation : OK

| | First Connector | | | | | Second Connector | | | | |
|----------------|------------------------|------------|-------------|----------|----------|------------------------|-------------|-----------|---------|----------|
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Initialisation | Reaction Force (N) | 0 | 0 | 0 | 0 | Reaction Force (N) | 0 | 0 | 0 | 0 |
| | Reaction Moment (N/m) | 0 | 0 | 0 | 0 | Reaction Moment (N/m) | 0 | 0 | 0 | 0 |
| | Pulling Force (N) | | | | 0 | Pulling Force (N) | | | | 0 |
| Mounting | | X | Y | Z | magn | | X | Y | Z | magn |
| | Reaction Force (N) | -319,916 | 398,291 | 0,359948 | 510,864 | Reaction Force (N) | 319,916 | -398,291 | 0,3289 | 510,864 |
| | Reaction Moment (N/m) | -0,0627285 | 0,000239354 | -78,8404 | 78,8404 | Reaction Moment (N/m) | 0,000239354 | 0,0475718 | 82,8053 | 82,8053 |
| Overall | | X | Y | Z | magn | | X | Y | Z | magn |
| | Max Reaction Force (N) | -319,916 | 398,291 | 0,359948 | 510,864 | Max Reaction Force (N) | 319,916 | -398,291 | 0,3289 | 510,864 |
| | Max Pulling Force (N) | | | | -398,291 | Max Pulling Force (N) | | | | -319,916 |

Figura 1. Informe bloque 1

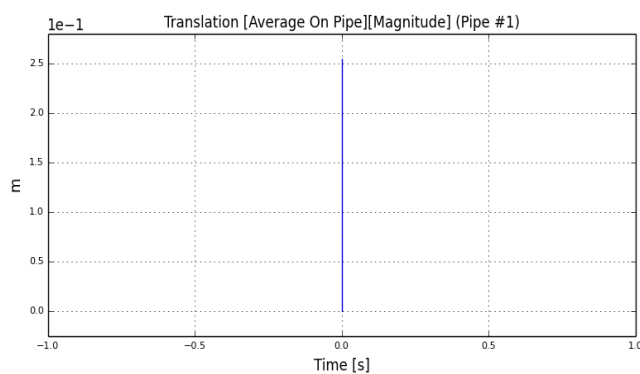


Figura 2. Traslado (promedio en el tubo)

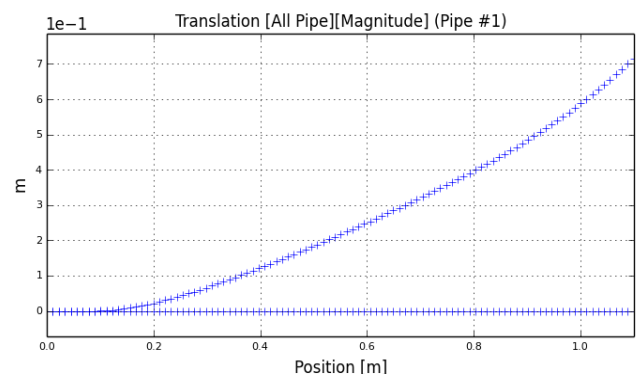


Figura 3. Traslado (en todo el tubo)

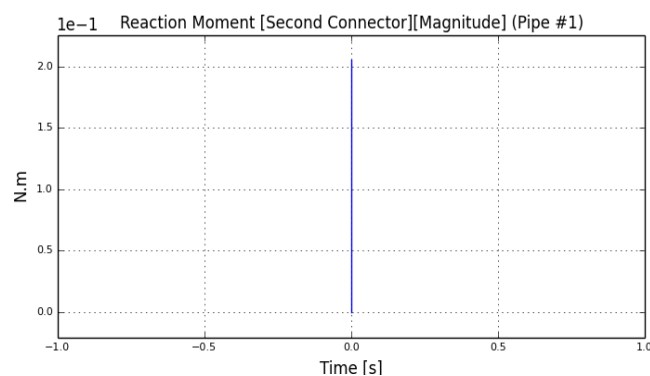


Figura 4. Momento de reacción

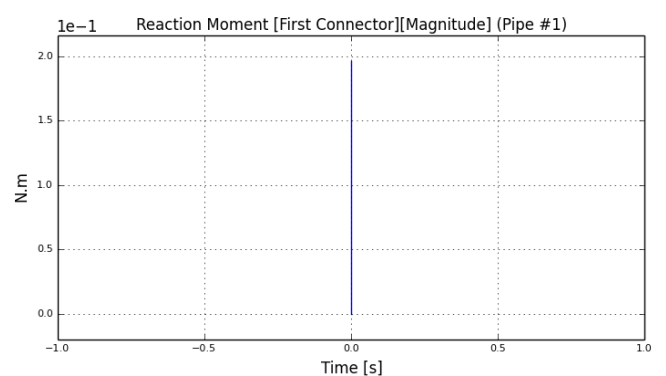


Figura 5. Momento de reacción

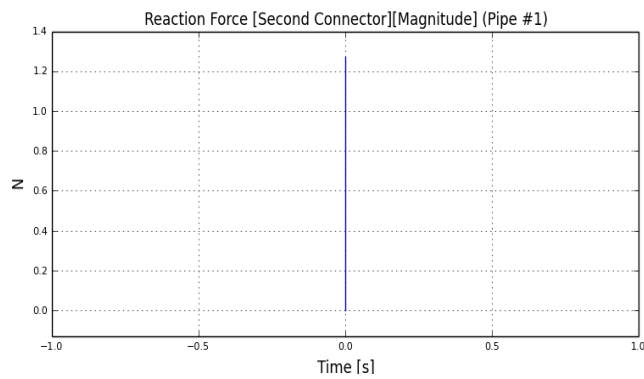


Figura 6. Fuerza de reacción

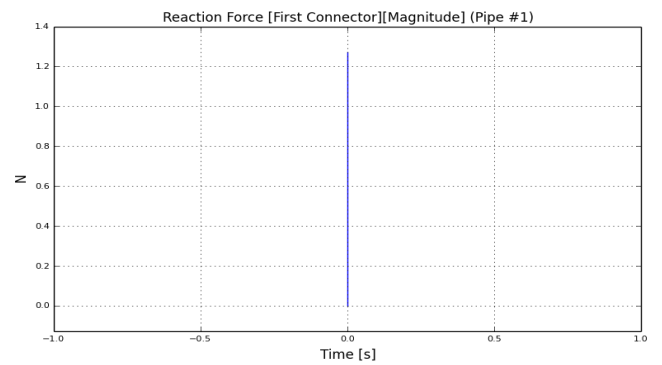


Figura 7. Fuerza de reacción

Bloque 2:

TEA Pipe.2

| | Geometrical Curve Radius | Torsion Angle (per unit of length) |
|----------------|--------------------------|------------------------------------|
| Initialisation | 1e+102 > 30 (mm) | 0 < +100 (deg/m) |
| Mounting | 37.1318 > 30 (mm) | -0.860723 > -100 (deg/m) |
| Overall | 37.1318 > 30 (mm) | -0.860723 > -100 (deg/m) |

TEA Pipe.2

Status of Computation : OK

| | First Connector | | | | | Second Connector | | | | |
|----------------|------------------------|------------|-----------|----------|---------|------------------------|-------------|-----------|----------|---------|
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Initialisation | Reaction Force (N) | 0 | 0 | 0 | 0 | Reaction Force (N) | 0 | 0 | 0 | 0 |
| | Reaction Moment (N/m) | 0 | 0 | 0 | 0 | Reaction Moment (N/m) | 0 | 0 | 0 | 0 |
| | Pulling Force (N) | | | | 0 | Pulling Force (N) | | | | 0 |
| Mounting | | X | Y | Z | magn | | X | Y | Z | magn |
| | Reaction Force (N) | 1,04977 | -10,3586 | 4,094 | 11,1877 | Reaction Force (N) | -1,04977 | 10,3586 | -3,95628 | 11,138 |
| | Reaction Moment (N/m) | 0,00020545 | -0,477995 | -1,21448 | 1,30516 | Reaction Moment (N/m) | -0,00020545 | -0,587837 | -1,53163 | 1,84056 |
| Overall | | X | Y | Z | magn | | X | Y | Z | magn |
| | Max Reaction Force (N) | 1,04977 | -10,3586 | 4,094 | 11,1877 | Max Reaction Force (N) | -1,04977 | 10,3586 | -3,95628 | 11,138 |
| | Max Pulling Force (N) | | | | 1,04977 | Max Pulling Force (N) | | | | 1,04977 |

Figura 8. Informe bloque 2

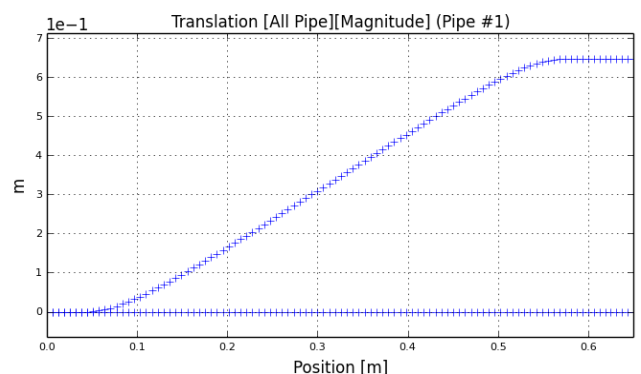
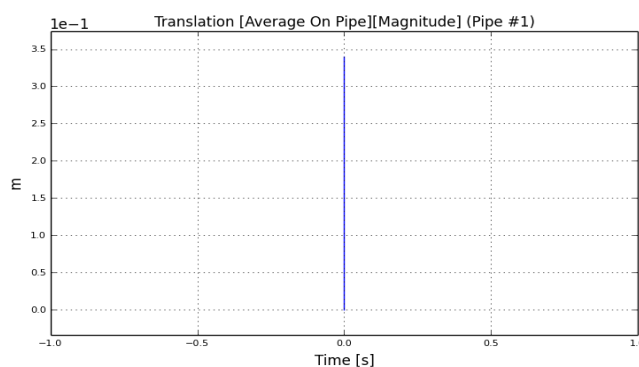


Figura 9. Traslado (promedio en el tubo) **Figura 10.** Traslado (en todo el tubo)

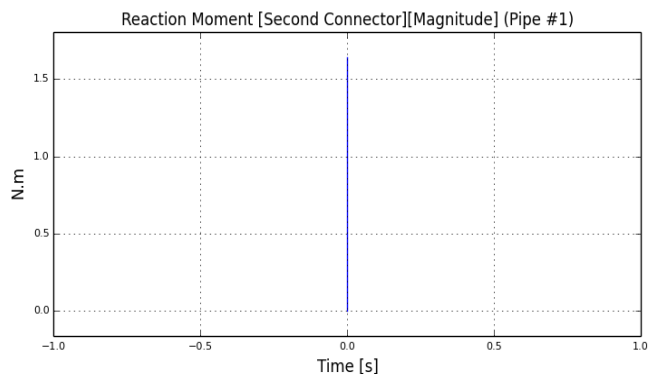


Figura 11. Momento de reacción

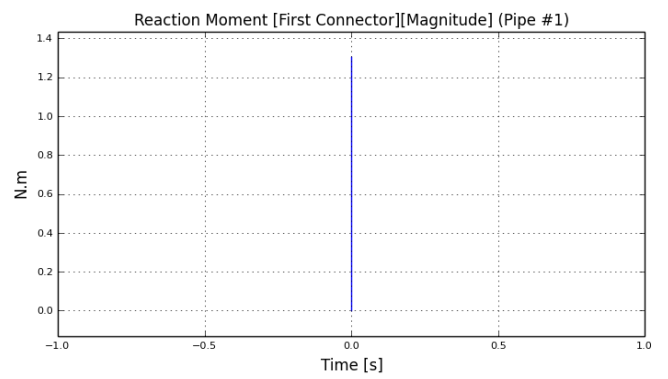


Figura 12. Momento de reacción

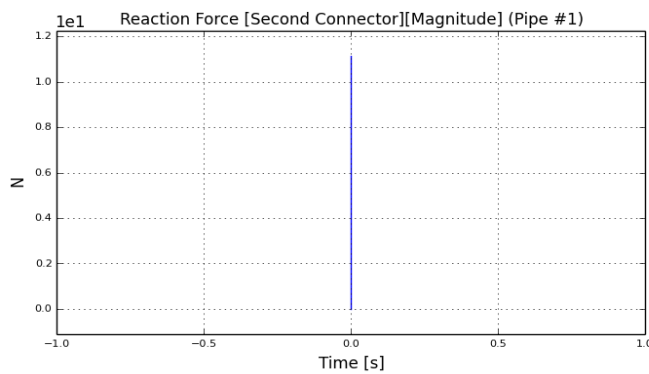


Figura 13. Fuerza de reacción

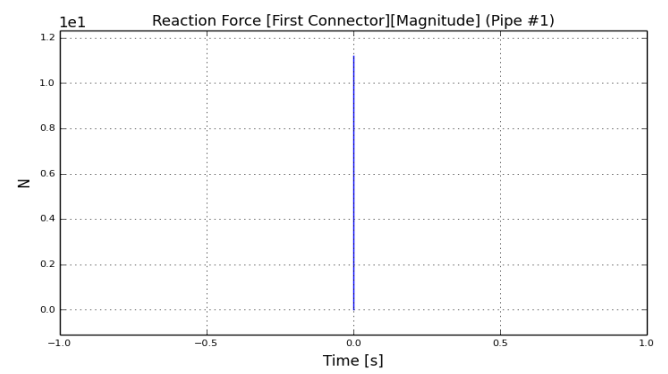


Figura 14. Fuerza de reacción

Bloque 3:

TEA Pipe.3

| | Geometrical Curve Radius | Torsion Angle (per unit of length) |
|----------------|--------------------------|------------------------------------|
| Initialisation | 1e+102 > 30 (mm) | 0 < +100 (deg/m) |
| Mounting | 149.989 > 30 (mm) | -0.482948 > -100 (deg/m) |
| Overall | 149.989 > 30 (mm) | -0.482948 > -100 (deg/m) |

TEA Pipe.3

Status of Computation : OK

| | First Connector | | | | | Second Connector | | | | |
|----------------|------------------------|-------------|----------|-----------|----------|------------------------|----------|-------------|-----------|-----------|
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Initialisation | Reaction Force (N) | 0 | 0 | 0 | 0 | Reaction Force (N) | 0 | 0 | 0 | 0 |
| | Reaction Moment (N/m) | 0 | 0 | 0 | 0 | Reaction Moment (N/m) | 0 | 0 | 0 | 0 |
| | Pulling Force (N) | | | | 0 | Pulling Force (N) | | | | 0 |
| Mounting | | X | Y | Z | magn | | X | Y | Z | magn |
| | Reaction Force (N) | -1.06981 | 0.739981 | -0.424039 | 1.36816 | Reaction Force (N) | 1.06981 | -0.739981 | 0.752454 | 1.50275 |
| | Reaction Moment (N/m) | 0.000136498 | 0.102147 | 0.165391 | 0.194392 | Reaction Moment (N/m) | 0.130795 | 0.000136498 | -0.194108 | 0.234063 |
| Overall | Pulling Force (N) | | | | -1.06981 | Pulling Force (N) | | | | -0.739979 |
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Overall | Max Reaction Force (N) | -1.06981 | 0.739981 | -0.424039 | 1.36816 | Max Reaction Force (N) | 1.06981 | -0.739981 | 0.752454 | 1.50275 |
| | Max Pulling Force (N) | | | | -1.06981 | Max Pulling Force (N) | | | | -0.739979 |

Figura 15. Informe bloque 3

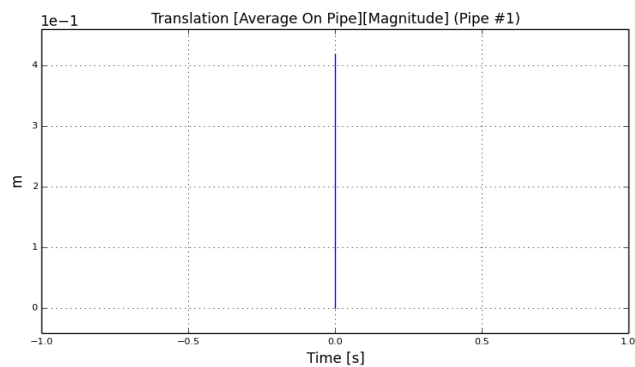


Figura 16. Traslado (promedio en el tubo)

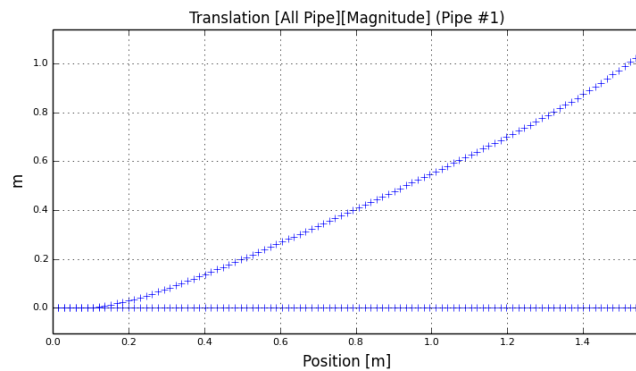


Figura 17. Traslado (en todo el tubo)

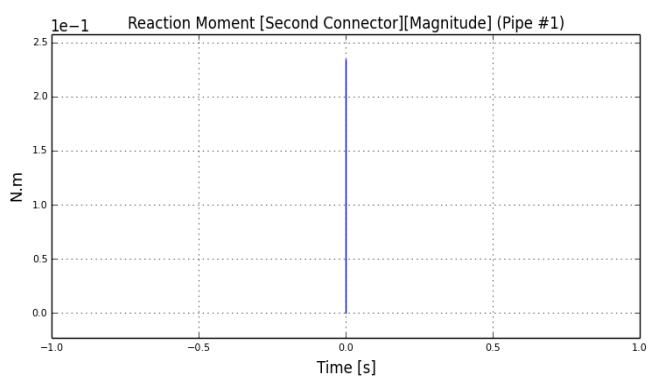


Figura 18. Momento de reacción

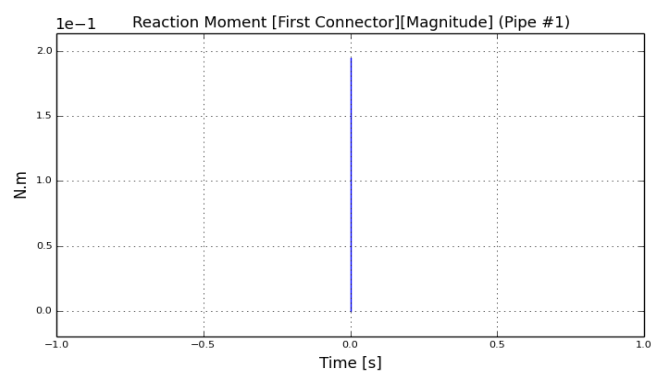


Figura 19. Momento de reacción

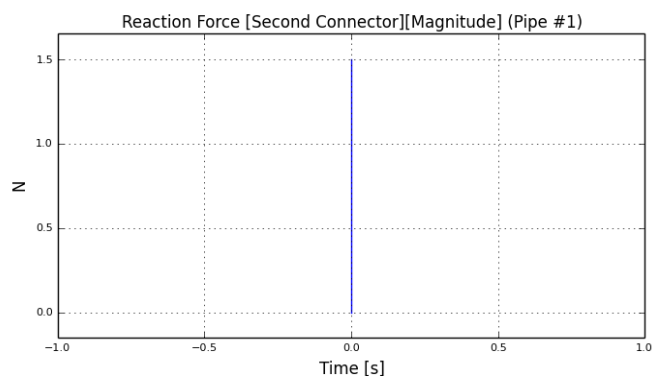


Figura 20. Fuerza de reacción

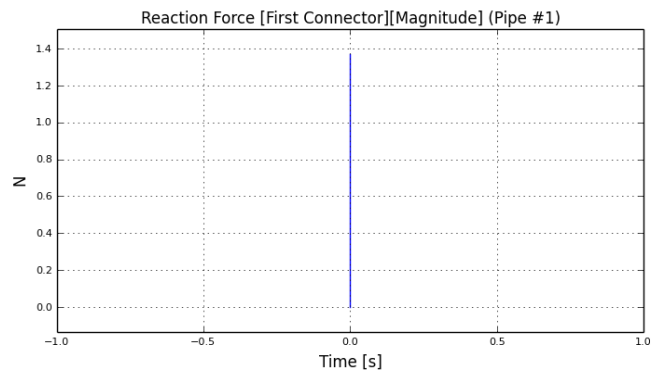


Figura 21. Fuerza de reacción

Bloque 4:

TEA Pipe.4

| | Geometrical Curve Radius | Torsion Angle (per unit of length) |
|----------------|--------------------------|------------------------------------|
| Initialisation | 1e+102 > 30 (mm) | 0 < +100 (deg/m) |
| Mounting | 57.985 > 30 (mm) | 0.914287 < +100 (deg/m) |
| Overall | 57.985 > 30 (mm) | 0.914287 < +100 (deg/m) |

TEA Pipe.4

Status of Computation : OK

| | First Connector | | | | | Second Connector | | | | |
|----------------|------------------------|----------|-------------|----------|----------|------------------------|----------|--------------|----------|----------|
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Initialisation | Reaction Force (N) | 0 | 0 | 0 | 0 | Reaction Force (N) | 0 | 0 | 0 | 0 |
| | Reaction Moment (N/m) | 0 | 0 | 0 | 0 | Reaction Moment (N/m) | 0 | 0 | 0 | 0 |
| | Pulling Force (N) | | | | 0 | Pulling Force (N) | | | | 0 |
| Mounting | | X | Y | Z | magn | | X | Y | Z | magn |
| | Reaction Force (N) | 7,51553 | 2,36634 | -3,43762 | 8,59652 | Reaction Force (N) | -7,51553 | -2,36634 | 3,72366 | 8,71484 |
| | Reaction Moment (N/m) | 0,327432 | 0,000247017 | 0,712485 | 0,784122 | Reaction Moment (N/m) | 0,406235 | -0,000247017 | 0,823665 | 0,918396 |
| Overall | | X | Y | Z | magn | | X | Y | Z | magn |
| | Max Reaction Force (N) | 7,51553 | 2,36634 | -3,43762 | 8,59652 | Max Reaction Force (N) | -7,51553 | -2,36634 | 3,72366 | 8,71484 |
| | Max Pulling Force (N) | | | | -2,36634 | Max Pulling Force (N) | | | | -2,36634 |

Figura 22. Informe bloque 4

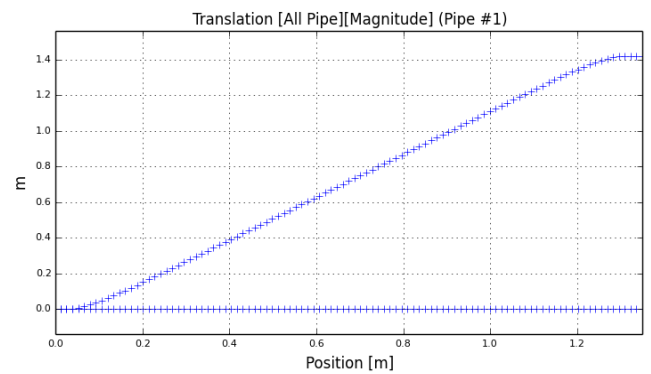
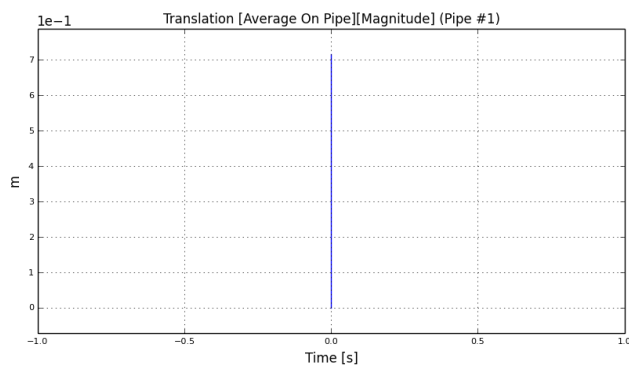


Figura 23. Traslado (promedio en el tubo) **Figura 24.** Traslado (en todo el tubo)

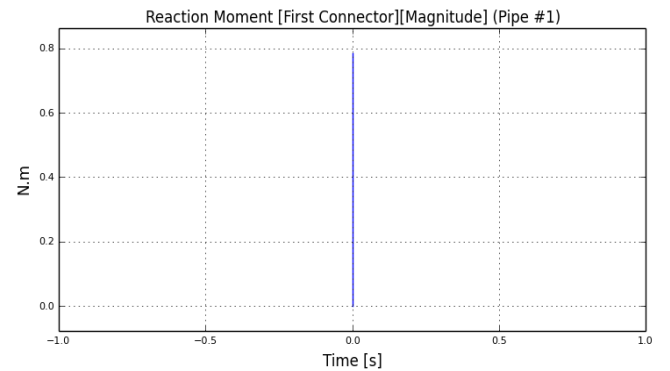
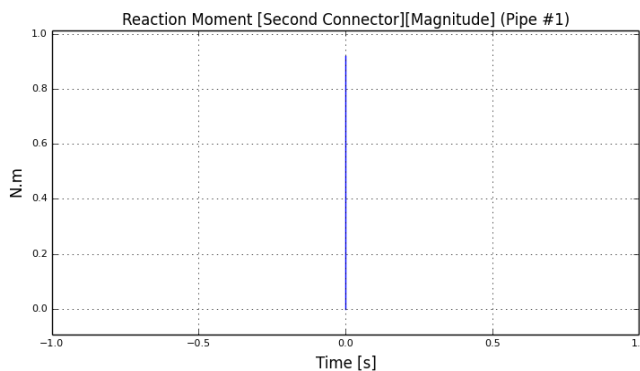


Figura 25. Momento de reacción

Figura 26. Momento de reacción

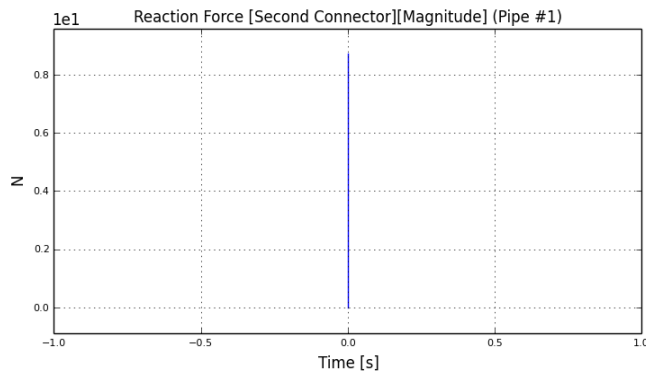


Figura 27. Fuerza de reacción

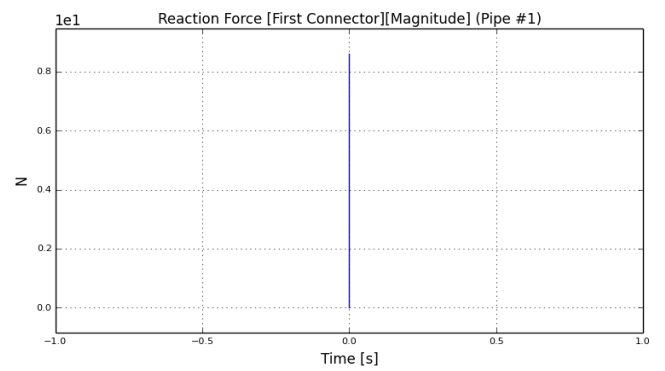


Figura 28. Fuerza de reacción

Bloque 5:

TEA Pipe.5

| | Geometrical Curve Radius | Torsion Angle (per unit of length) |
|----------------|--------------------------|------------------------------------|
| Initialisation | 1e+102 > 30 (mm) | 0 < +100 (deg/m) |
| Mounting | 97.9999 > 30 (mm) | -1.13179 > -100 (deg/m) |
| Overall | 97.9999 > 30 (mm) | -1.13179 > -100 (deg/m) |

TEA Pipe.5

Status of Computation : OK

| | First Connector | | | | | Second Connector | | | | |
|----------------|------------------------|----------|--------------|-----------|----------|------------------------|-----------|-------------|------------|----------|
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Initialisation | Reaction Force (N) | 0 | 0 | 0 | 0 | Reaction Force (N) | 0 | 0 | 0 | 0 |
| | Reaction Moment (N/m) | 0 | 0 | 0 | 0 | Reaction Moment (N/m) | 0 | 0 | 0 | 0 |
| | Pulling Force (N) | | | | 0 | Pulling Force (N) | | | | 0 |
| Mounting | Reaction Force (N) | 0.132511 | -2.35648 | 0.148081 | 2.36484 | Reaction Force (N) | -0.132511 | 2.35648 | -0.0527349 | 2.36079 |
| | Reaction Moment (N/m) | 0.155352 | -0.000322201 | -0.214217 | 0.264619 | Reaction Moment (N/m) | 0.165848 | 0.000322201 | -0.214675 | 0.271276 |
| | Pulling Force (N) | | | | 2.35648 | Pulling Force (N) | | | | 2.35648 |
| Overall | | X | Y | Z | magn | | X | Y | Z | magn |
| | Max Reaction Force (N) | 0.132511 | -2.35648 | 0.148081 | 2.36484 | Max Reaction Force (N) | -0.132511 | 2.35648 | -0.0527349 | 2.36079 |
| | Max Pulling Force (N) | | | | 2.35648 | Max Pulling Force (N) | | | | 2.35648 |

Figura 29. Informe bloque 5

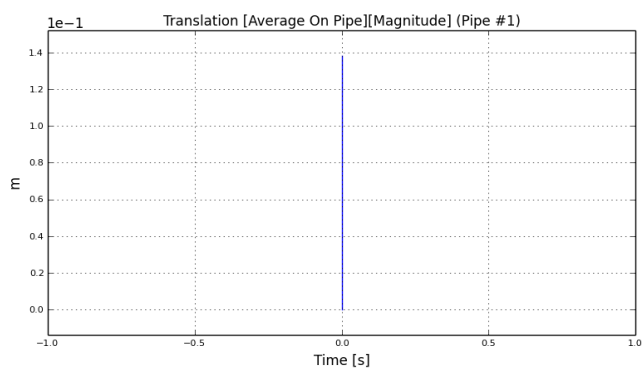


Figura 30. Traslado (promedio en el tubo)

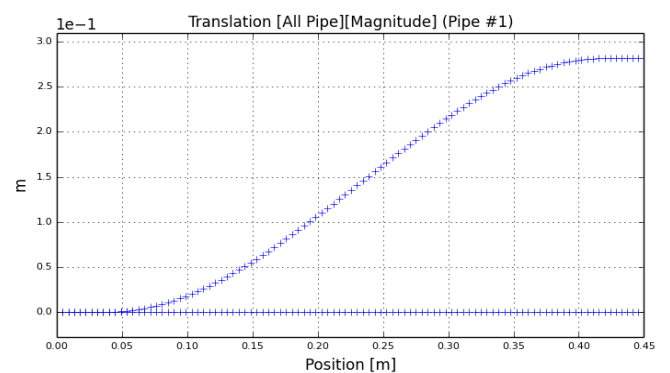


Figura 31. Traslado (en todo el tubo)

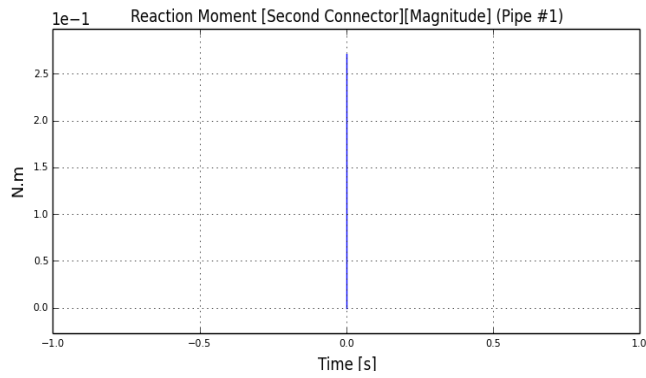


Figura 32. Momento de reacción

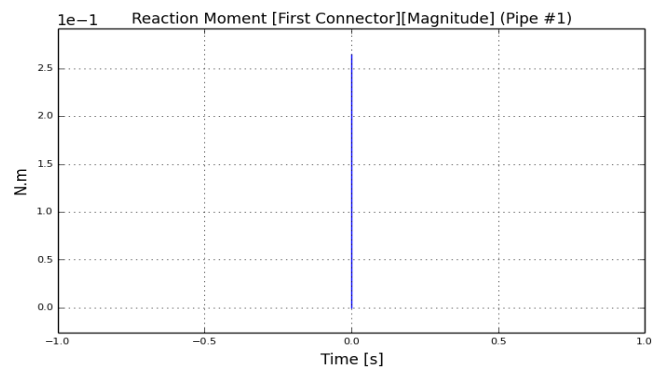


Figura 33. Momento de reacción

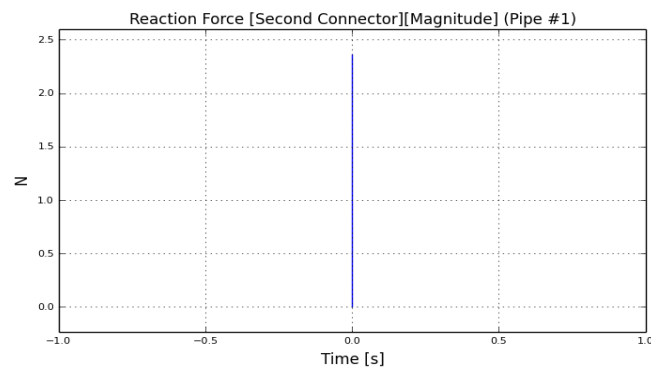


Figura 34. Fuerza de reacción

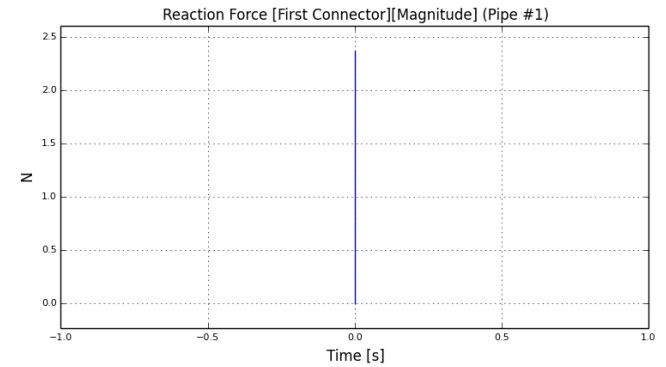


Figura 35. Fuerza de reacción

Bloque 6:

TEA Pipe.6

| | Geometrical Curve Radius | Torsion Angle (per unit of length) |
|----------------|--------------------------|------------------------------------|
| Initialisation | 1e+102 > 30 (mm) | 0 < +100 (deg/m) |
| Mounting | 39.8577 > 30 (mm) | 2.80204 < +100 (deg/m) |
| Overall | 39.8577 > 30 (mm) | 2.80204 < +100 (deg/m) |

TEA Pipe.6

Status of Computation : OK

| | First Connector | | | | | Second Connector | | | | |
|----------------|------------------------|----------|--------------|----------|---------|------------------------|-----------|-----------|-------------|----------|
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Initialisation | Reaction Force (N) | 0 | 0 | 0 | 0 | Reaction Force (N) | 0 | 0 | 0 | 0 |
| | Reaction Moment (N/m) | 0 | 0 | 0 | 0 | Reaction Moment (N/m) | 0 | 0 | 0 | 0 |
| | Pulling Force (N) | | | | 0 | Pulling Force (N) | | | | 0 |
| Mounting | | X | Y | Z | magn | | X | Y | Z | magn |
| | Reaction Force (N) | -2,32398 | 4,37823 | 1,02534 | 5,06173 | Reaction Force (N) | 2,32398 | -4,37823 | -0,771084 | 5,01641 |
| | Reaction Moment (N/m) | 0,311016 | -0,000645566 | 0,728725 | 0,79232 | Reaction Moment (N/m) | -0,881444 | -0,362573 | 0,000645566 | 0,771897 |
| Overall | Pulling Force (N) | | | | 4,37823 | Pulling Force (N) | | | | 0,771082 |
| | | X | Y | Z | magn | | X | Y | Z | magn |
| | Max Reaction Force (N) | -2,32398 | 4,37823 | 1,02534 | 5,06173 | Max Reaction Force (N) | 2,32398 | -4,37823 | -0,771084 | 5,01641 |
| | Max Pulling Force (N) | | | | 4,37823 | Max Pulling Force (N) | | | | 0,771082 |

Figura 36. Informe bloque 6

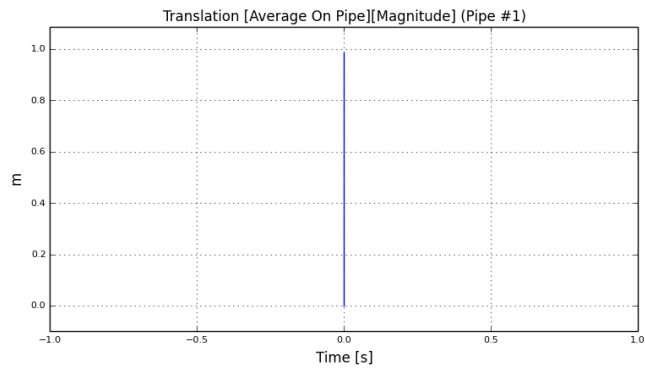


Figura 37. Traslado (promedio en el tubo)

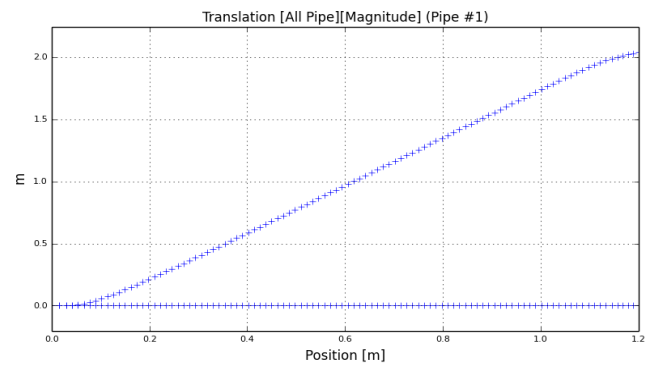


Figura 38. Traslado (en todo el tubo)

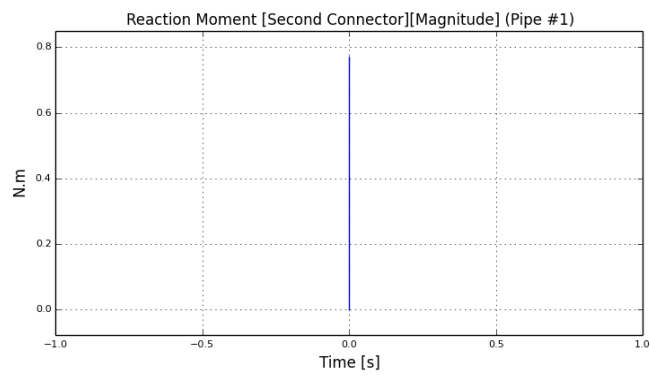


Figura 39. Momento de reacción

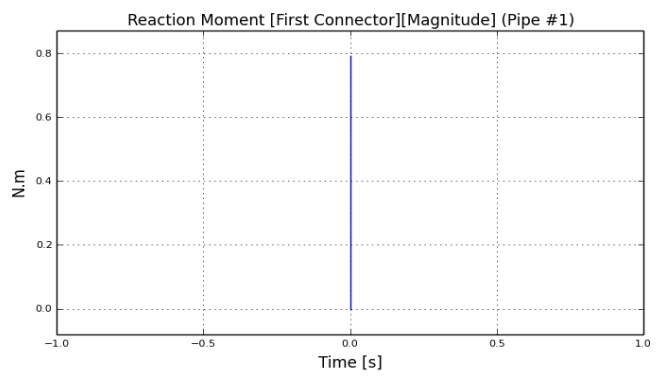


Figura 40. Momento de reacción

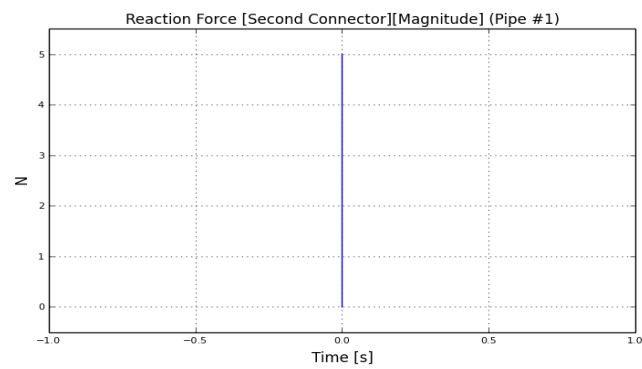


Figura 41. Fuerza de reacción

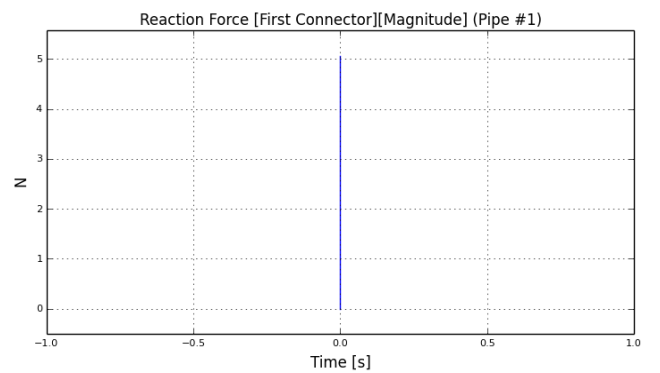


Figura 42. Fuerza de reacción

Bloque 7:

TEA Pipe.7

| | Geometrical Curve Radius | Torsion Angle (per unit of length) |
|----------------|--------------------------|------------------------------------|
| Initialisation | 1e+102 > 30 (mm) | 0 < +100 (deg/m) |
| Mounting | 88,7555 > 30 (mm) | 1,03322 < +100 (deg/m) |
| Overall | 88,7555 > 30 (mm) | 1,03322 < +100 (deg/m) |

TEA Pipe.7

Status of Computation : OK

| | First Connector | | | | | Second Connector | | | | |
|----------------|------------------------|-----------|-------------|---------|----------|------------------------|-----------|--------------|----------|----------|
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Initialisation | Reaction Force (N) | 0 | 0 | 0 | 0 | Reaction Force (N) | 0 | 0 | 0 | 0 |
| | Reaction Moment (N/m) | 0 | 0 | 0 | 0 | Reaction Moment (N/m) | 0 | 0 | 0 | 0 |
| | Pulling Force (N) | | | | 0 | Pulling Force (N) | | | | 0 |
| Mounting | | X | Y | Z | magn | | X | Y | Z | magn |
| | Reaction Force (N) | 12,5054 | 1,42432 | 3,35385 | 13,0255 | Reaction Force (N) | -12,5054 | -1,42432 | -2,80296 | 12,8946 |
| | Reaction Moment (N/m) | -0,466353 | 0,000237987 | 1,7484 | 1,80953 | Reaction Moment (N/m) | -0,271652 | -0,000237987 | 1,20544 | 1,23567 |
| | Pulling Force (N) | | | | -1,42432 | Pulling Force (N) | | | | -1,42432 |
| Overall | | X | Y | Z | magn | | X | Y | Z | magn |
| | Max Reaction Force (N) | 12,5054 | 1,42432 | 3,35385 | 13,0255 | Max Reaction Force (N) | -12,5054 | -1,42432 | -2,80296 | 12,8946 |
| | Max Pulling Force (N) | | | | -1,42432 | Max Pulling Force (N) | | | | -1,42432 |

Figura 43. Informe bloque 7

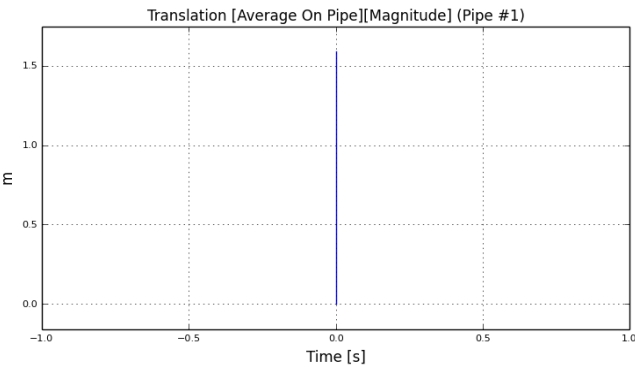


Figura 44. Traslado (promedio en el tubo)

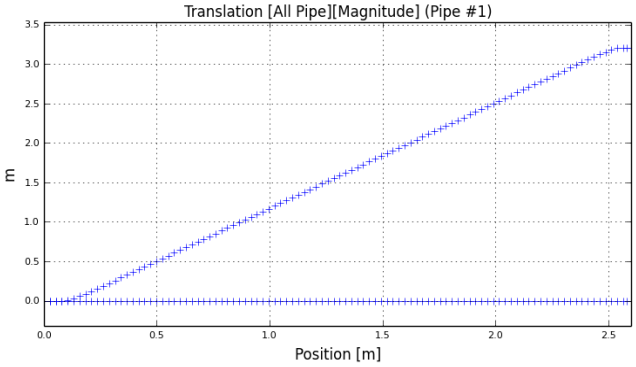


Figura 45. Traslado (en todo el tubo)

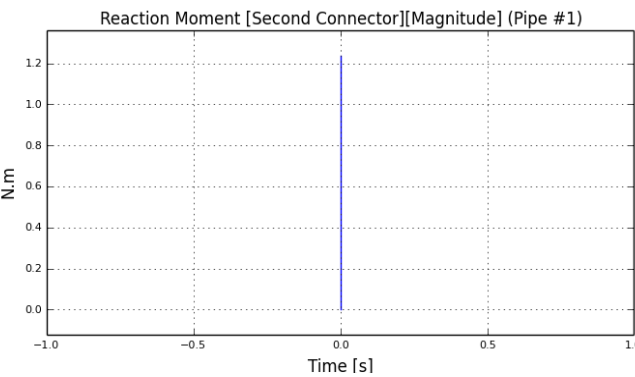


Figura 46. Momento de reacción

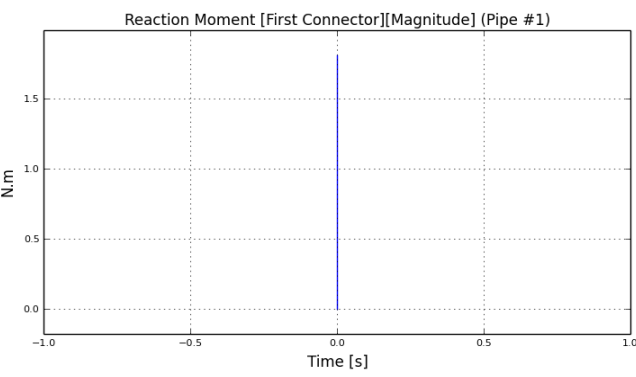


Figura 47. Momento de reacción

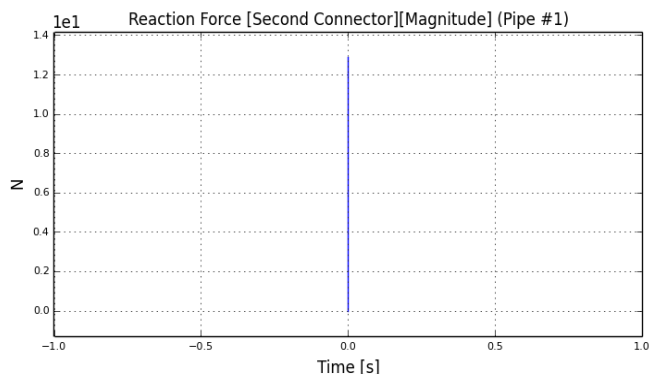


Figura 48. Fuerza de reacción

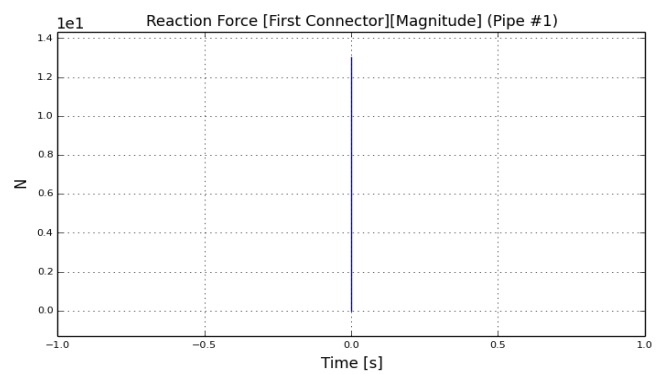


Figura 49. Fuerza de reacción

Bloque 8: TEA Pipe.8

| | Geometrical Curve Radius | Torsion Angle (per unit of length) |
|----------------|--------------------------|------------------------------------|
| Initialisation | 1e+102 > 30 (mm) | 0 < +100 (deg/m) |
| Mounting | 87.5028 > 30 (mm) | -1.00907 > -100 (deg/m) |
| Overall | 87.5028 > 30 (mm) | -1.00907 > -100 (deg/m) |

TEA Pipe.8

Status of Computation : OK

| | First Connector | | | | | Second Connector | | | | |
|----------------|------------------------|----------|--------------|----------|----------|------------------------|----------|-------------|----------|----------|
| | | X | Y | Z | magn | | X | Y | Z | magn |
| Initialisation | Reaction Force (N) | 0 | 0 | 0 | 0 | Reaction Force (N) | 0 | 0 | 0 | 0 |
| | Reaction Moment (N/m) | 0 | 0 | 0 | 0 | Reaction Moment (N/m) | 0 | 0 | 0 | 0 |
| | Pulling Force (N) | | | | 0 | Pulling Force (N) | | | | 0 |
| Mounting | Reaction Force (N) | -8.22045 | 1.59377 | -2.70252 | 8.9669 | Reaction Force (N) | 8.22045 | -1.59377 | 2.9038 | 7.04742 |
| | Reaction Moment (N/m) | 0.310592 | -0.000277564 | -0.71008 | 0.775036 | Reaction Moment (N/m) | 0.314359 | 0.000277564 | -0.67763 | 0.746998 |
| | Pulling Force (N) | | | | -1.59377 | Pulling Force (N) | | | | -1.59377 |
| Overall | | X | Y | Z | magn | | X | Y | Z | magn |
| | Max Reaction Force (N) | -8.22045 | 1.59377 | -2.70252 | 8.9669 | Max Reaction Force (N) | 8.22045 | -1.59377 | 2.9038 | 7.04742 |
| | Max Pulling Force (N) | | | | -1.59377 | Max Pulling Force (N) | | | | -1.59377 |

Figura 50. Informe bloque 8

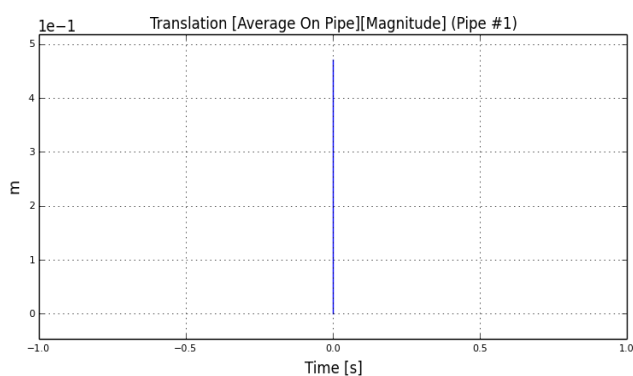


Figura 51. Traslado (promedio en el tubo)

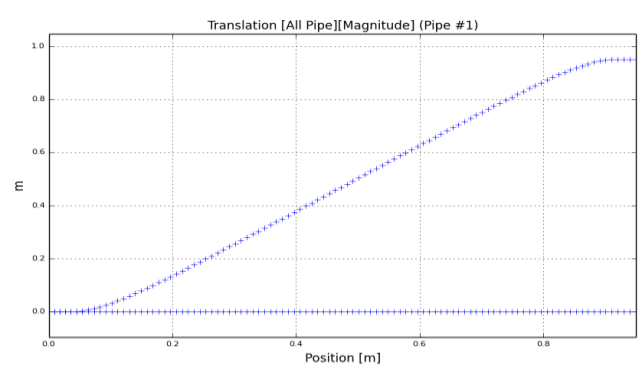


Figura 52. Traslado (en todo el tubo)

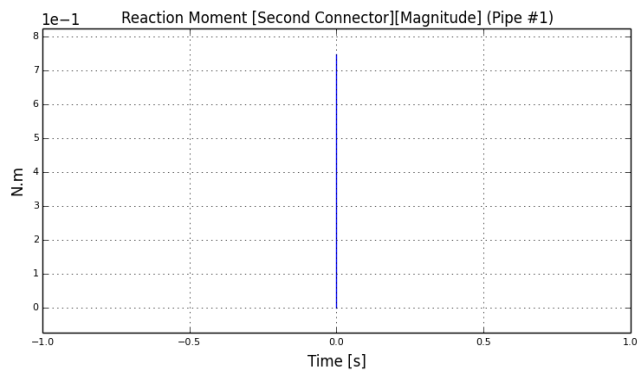


Figura 53. Momento de reacción

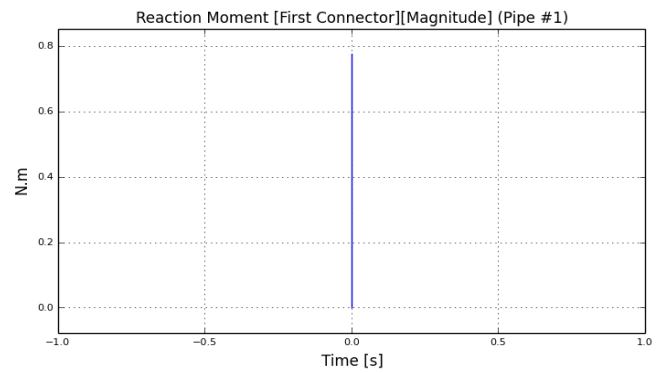


Figura 54. Momento de reacción

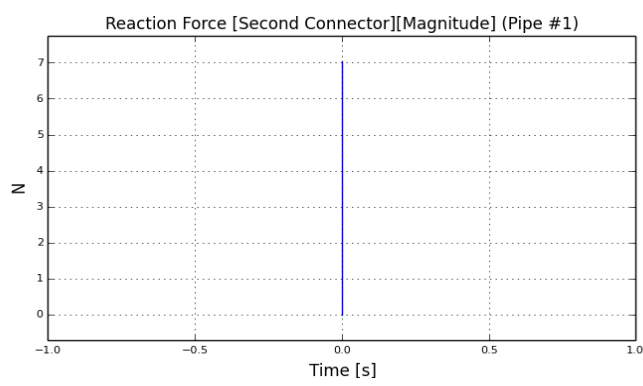


Figura 55. Fuerza de reacción

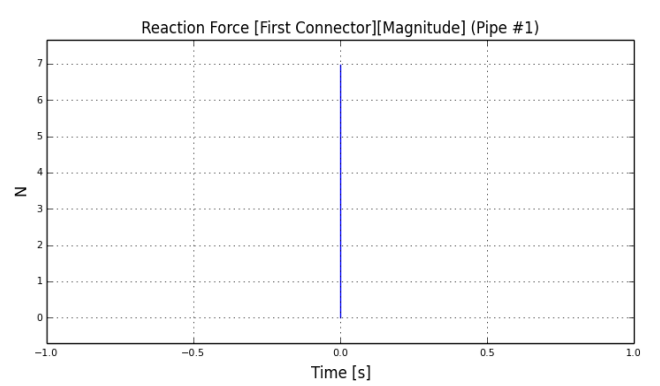


Figura 56. Fuerza de reacción

2. Simulación utilizando la optimización

Se muestran los gráficos del estudio paramétrico y de la optimización.

Bloque 1:

1. Estudio paramétrico

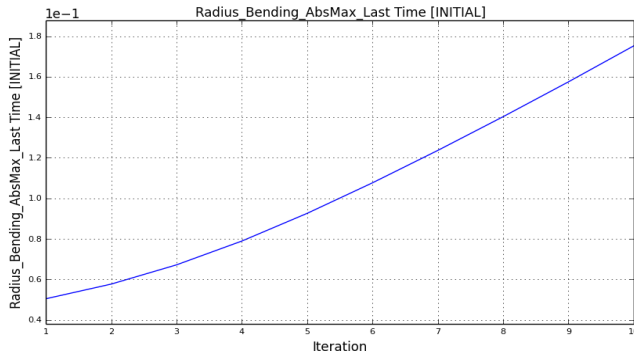


Figura 57. Radio en cada iteración

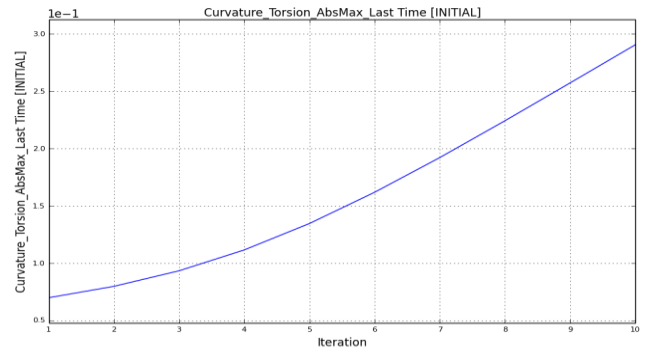


Figura 58. Torsión en cada iteración

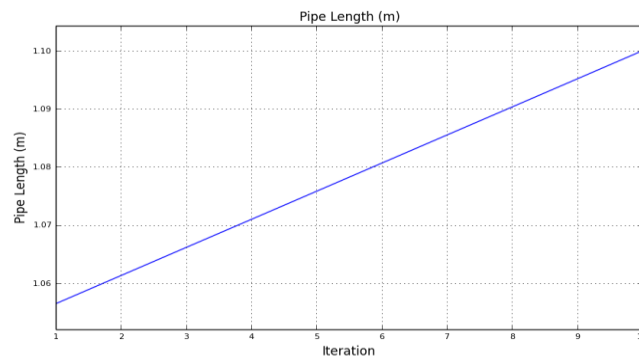


Figura 59. Longitud en cada iteración

2. Optimización

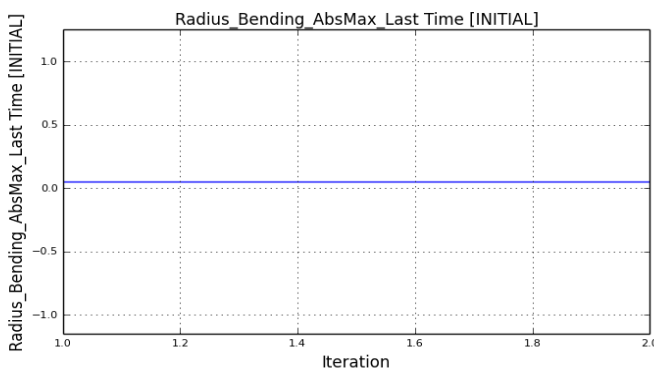


Figura 60. Radio en cada iteración

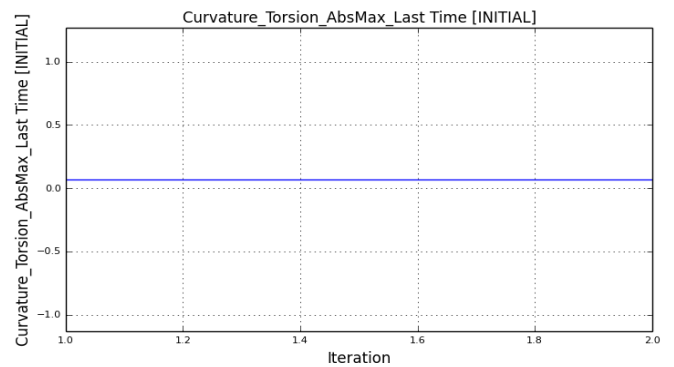


Figura 61. Torsión en cada iteración

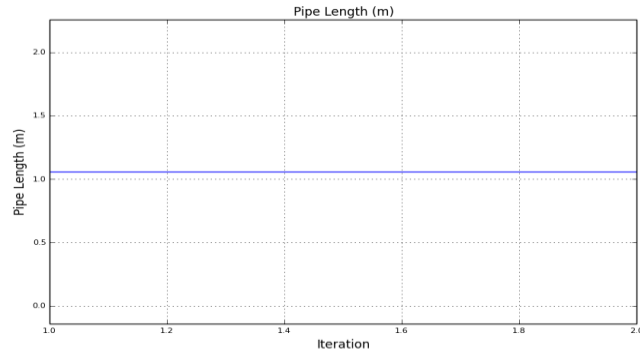


Figura 62. Longitud en cada iteración

Bloque 2:

1. Estudio paramétrico

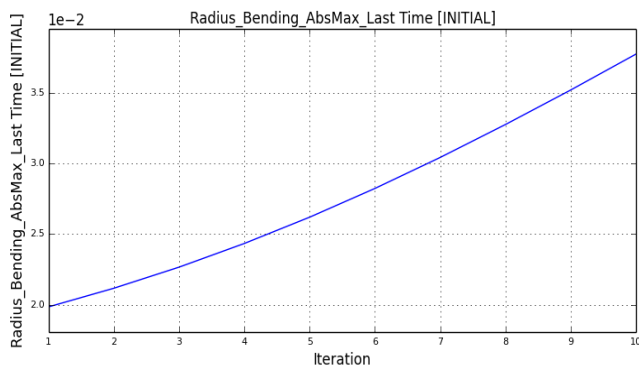


Figura 63. Radio en cada iteración

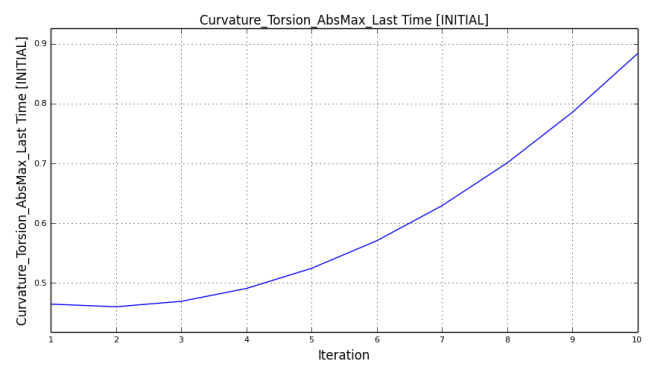


Figura 64. Torsión en cada iteración

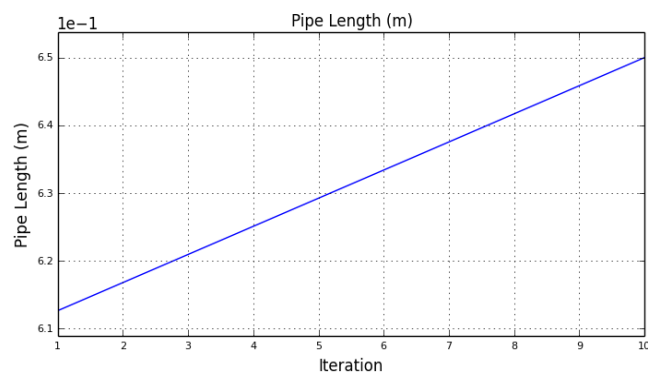


Figura 65. Longitud en cada iteración

2. Optimización

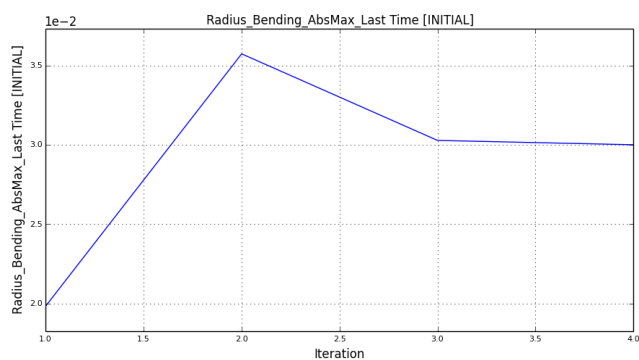


Figura 66. Radio en cada iteración

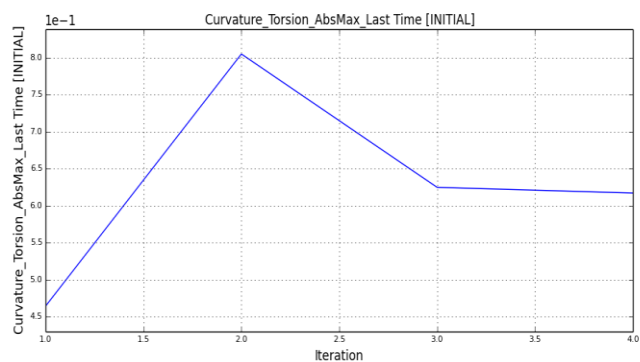


Figura 67. Torsión en cada iteración

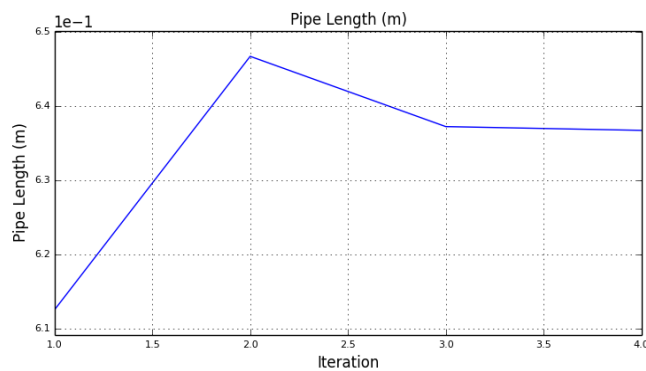


Figura 68. Longitud en cada iteración

Bloque 3:

1. Estudio paramétrico

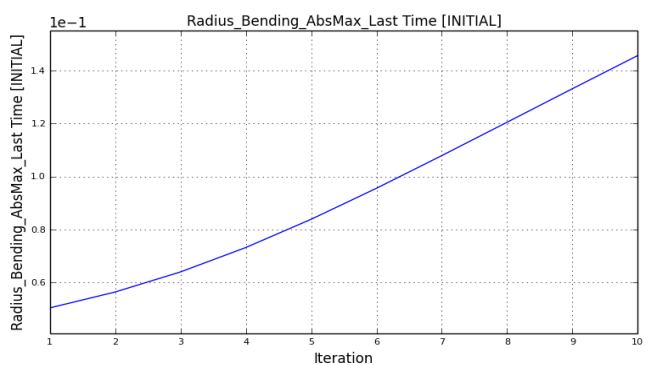


Figura 69. Radio en cada iteración

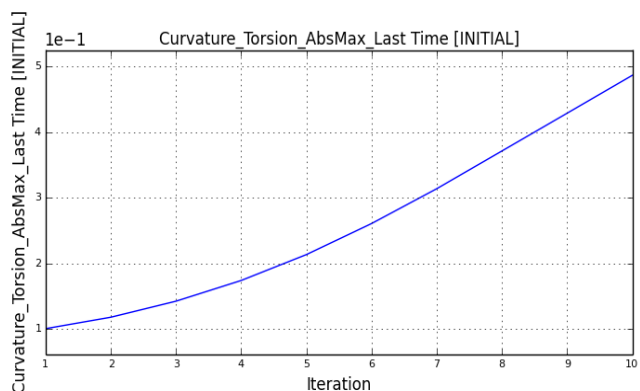


Figura 70. Torsión en cada iteración

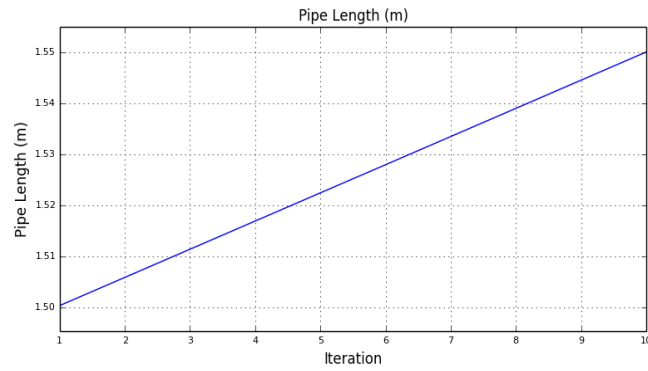


Figura 71. Longitud en cada iteración

2. Optimización

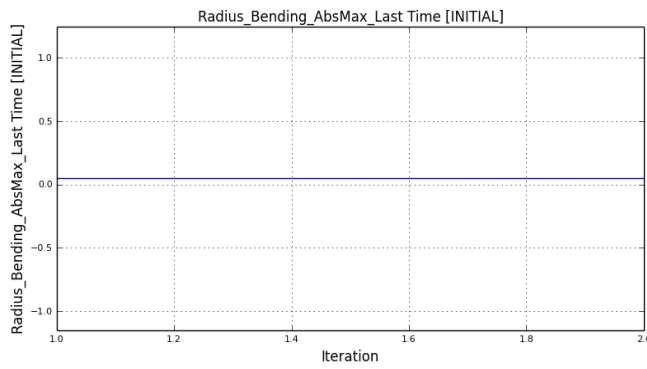


Figura 72. Radio en cada iteración

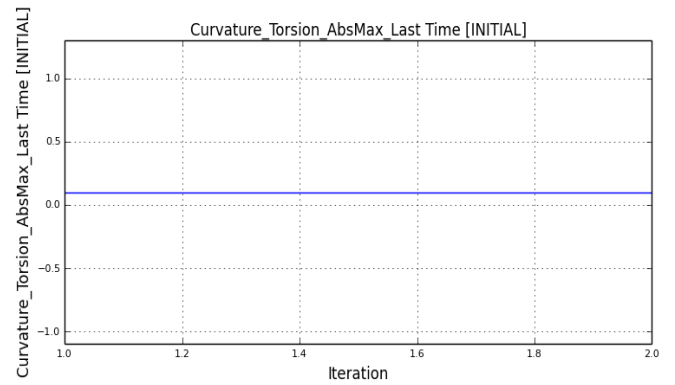


Figura 73. Torsión en cada iteración

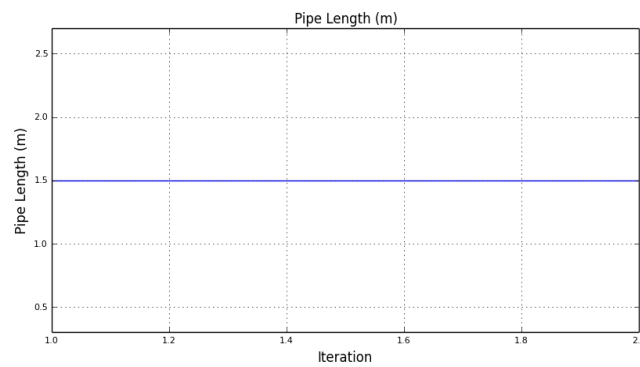


Figura 74. Longitud en cada iteración

Bloque 4:
1. Estudio paramétrico

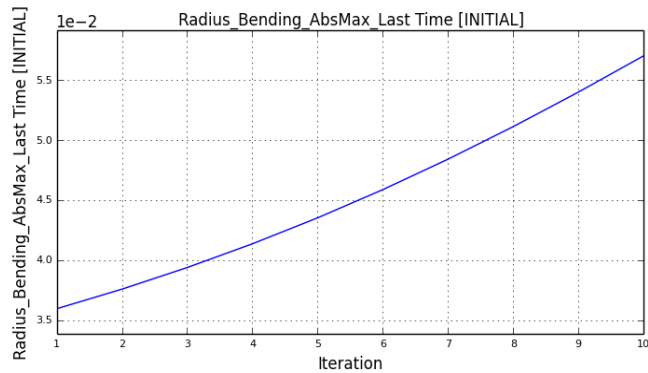


Figura 75. Radio en cada iteración

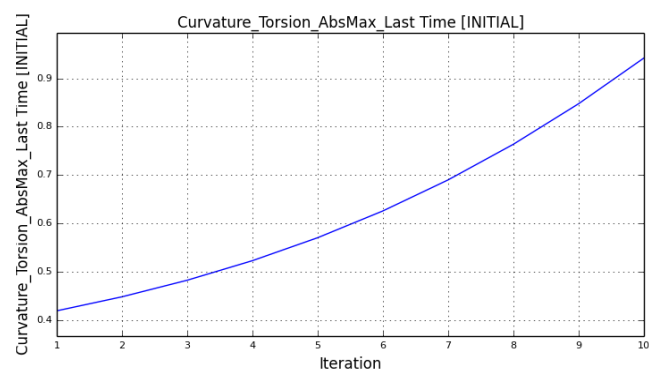


Figura 76. Torsión en cada iteración

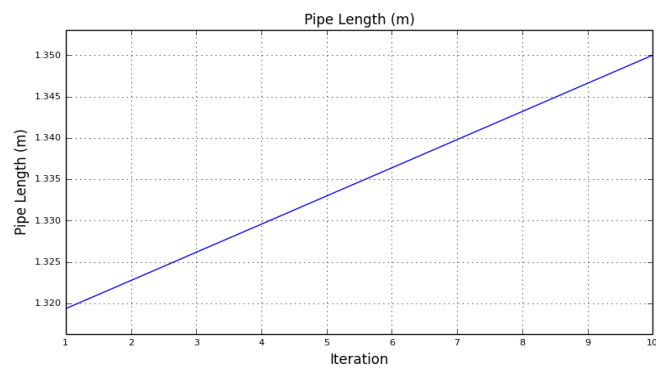


Figura 77. Longitud en cada iteración

2. Optimización

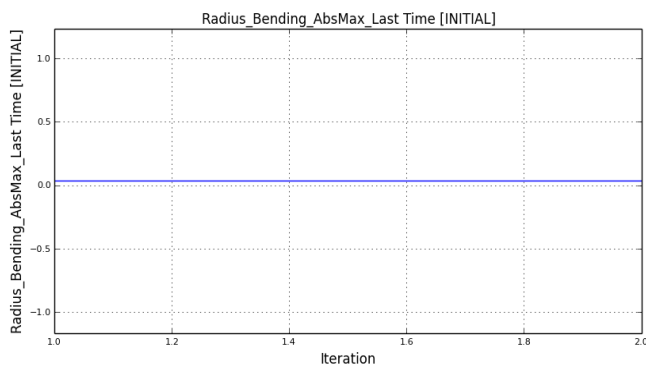


Figura 78. Radio en cada iteración

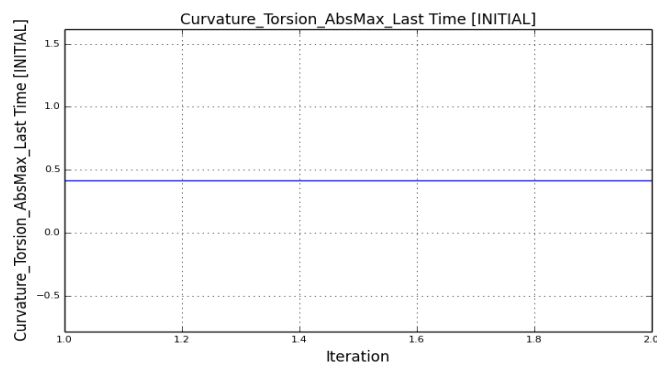


Figura 79. Torsión en cada iteración

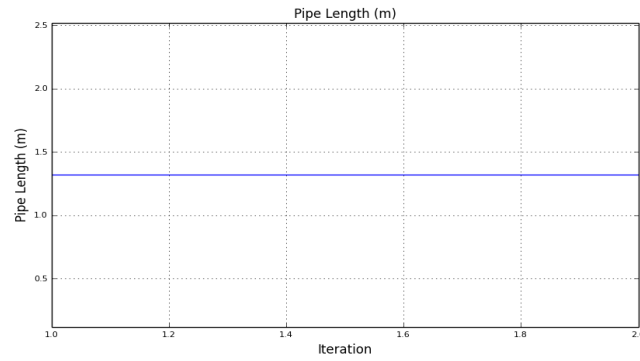


Figura 80. Longitud en cada iteración

Bloque 5:

1. Estudio paramétrico

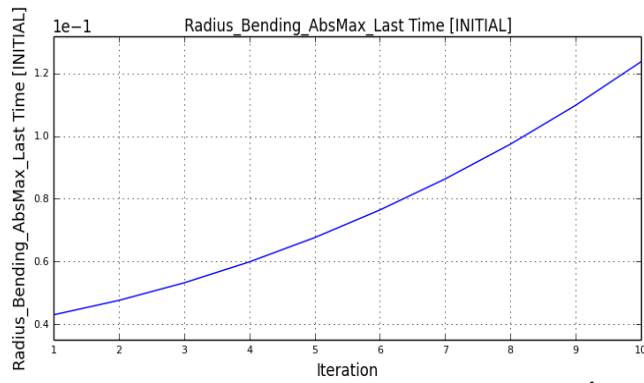


Figura 81. Radio en cada iteración

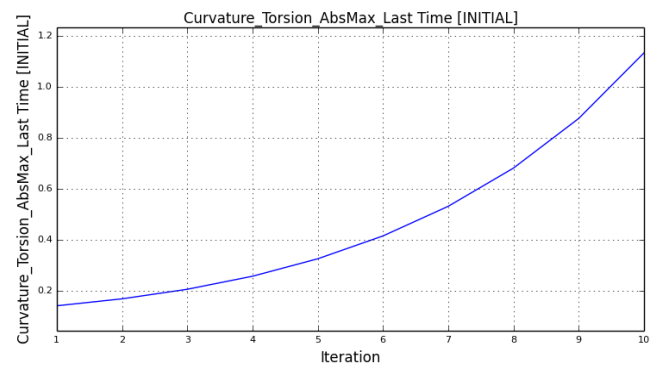


Figura 82. Torsión en cada iteración

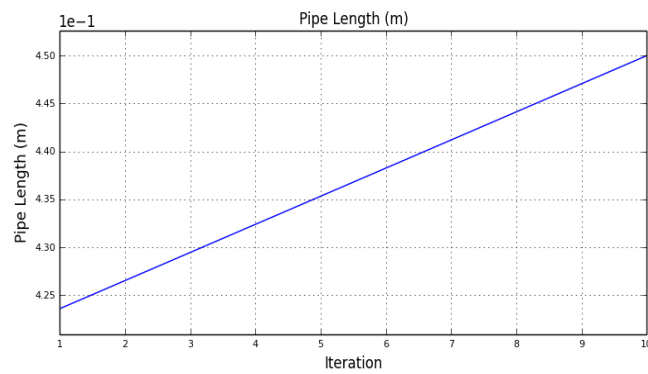


Figura 83. Longitud en cada iteración

2. Optimización

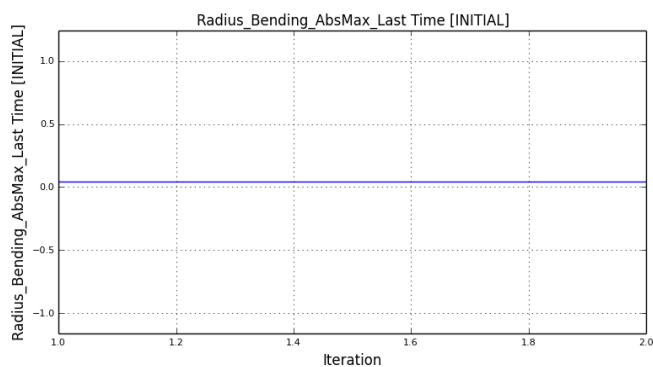


Figura 84. Radio en cada iteración

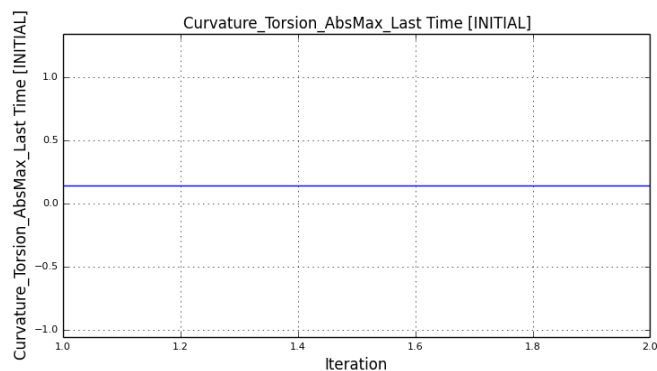


Figura 85. Torsión en cada iteración

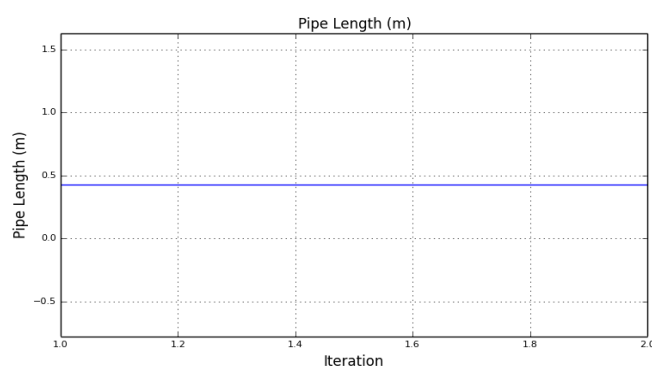


Figura 86. Longitud en cada iteración

Bloque 6:

1. Estudio paramétrico

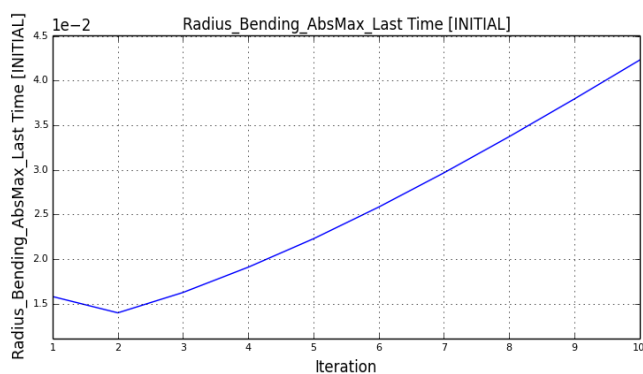


Figura 87. Radio en cada iteración

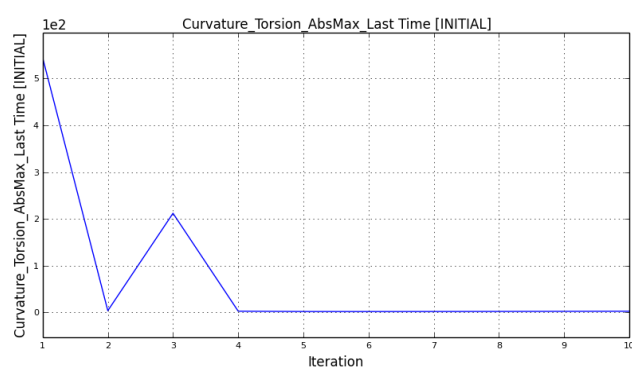


Figura 88. Torsión en cada iteración

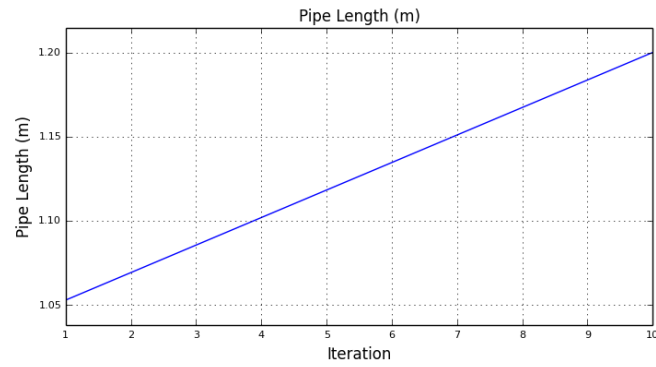


Figura 89. Longitud en cada iteración

Bloque 7:

1. Estudio paramétrico

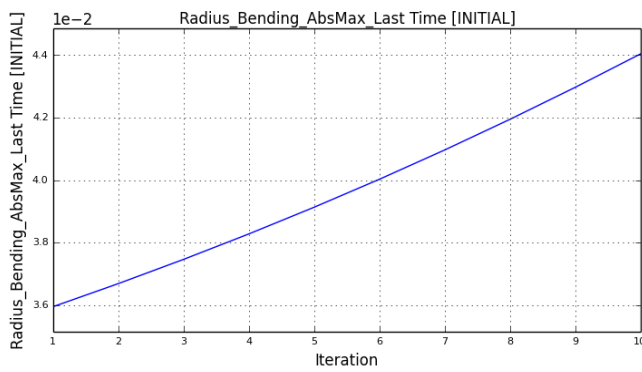


Figura 90. Radio en cada iteración

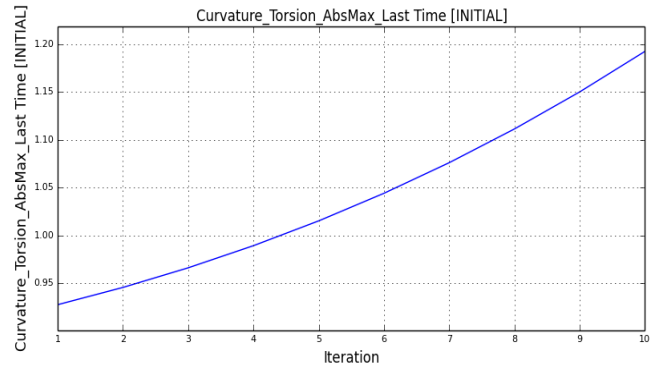


Figura 91. Torsión en cada iteración

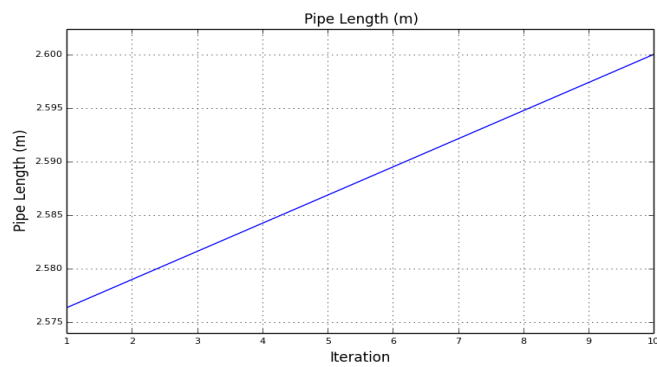


Figura 92. Longitud en cada iteración

2. Optimización

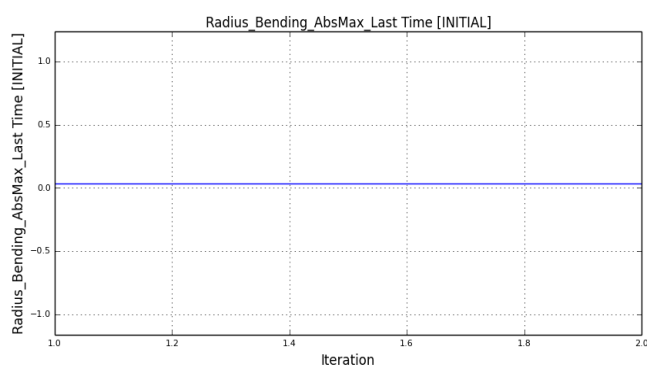


Figura 93. Radio en cada iteración

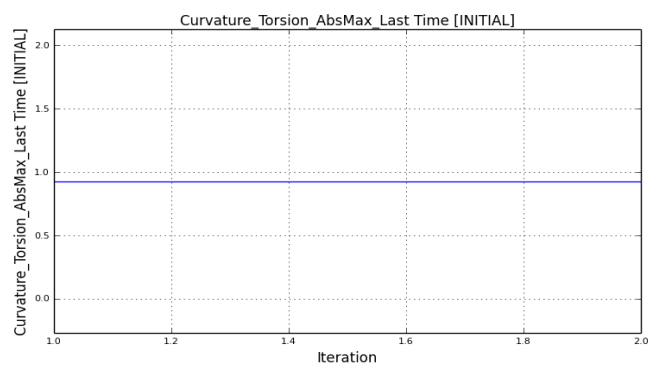


Figura 94. Torsión en cada iteración

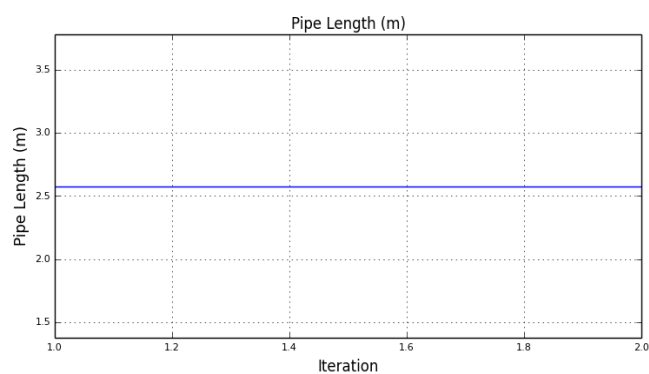


Figura 95. Longitud en cada iteración

Bloque 8:

1. Estudio paramétrico

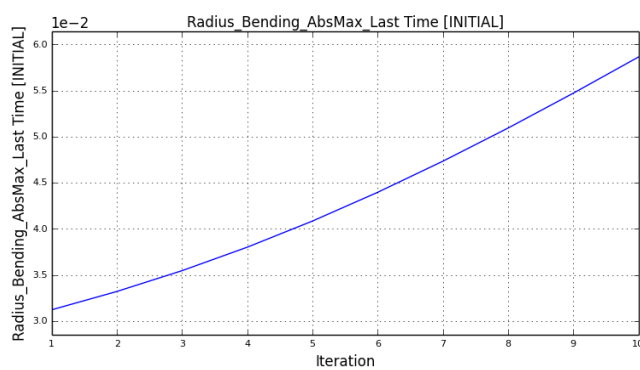


Figura 96. Radio en cada iteración

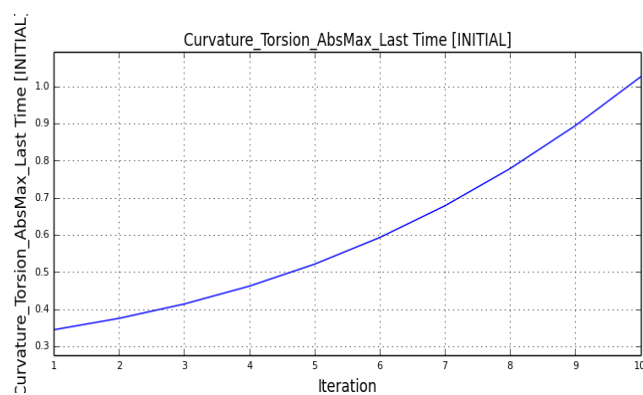


Figura 97. Torsión en cada iteración

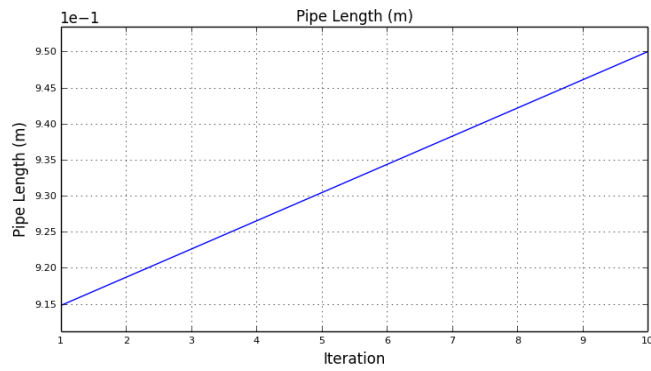


Figura 98. Longitud en cada iteración

2. Optimización

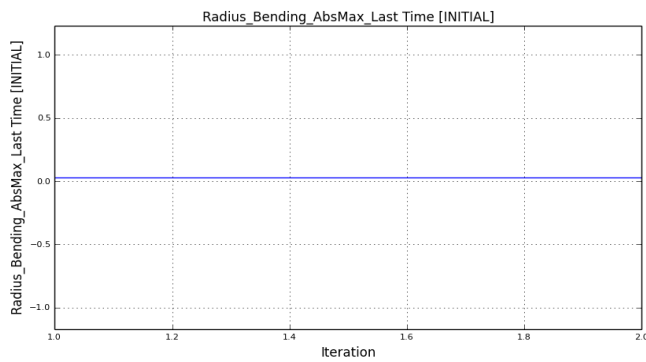


Figura 99. Radio en cada iteración

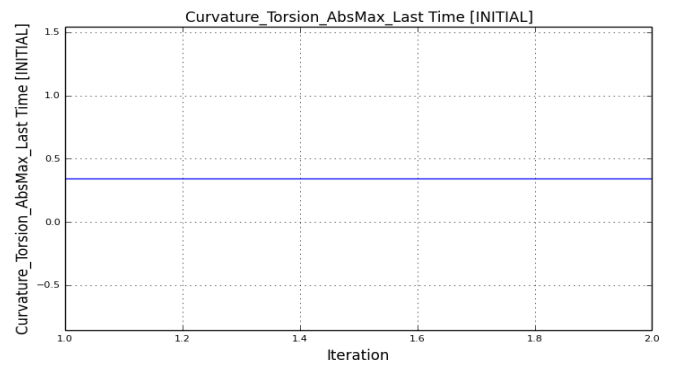


Figura 100. Torsión en cada iteración

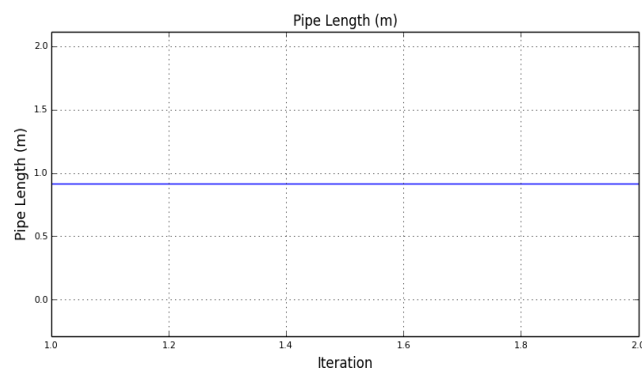


Figura 101. Longitud en cada iteración

3. Análisis del modo de vibración

Se muestran las frecuencias de cada nodo en el bloque 7 y en cada rango de frecuencia.

Bloque 7:

Frecuencia: [0 Hz ; 1000 Hz]

Tabla 1. Frecuencia en cada nodo.

| | |
|----------------------------------|-----------------------------------|
| Vibration mode 1 (f=5,06322 Hz) | Vibration mode 55 (f=199,245 Hz) |
| Vibration mode 2 (f=5,14098 Hz) | Vibration mode 56 (f=199,901 Hz) |
| Vibration mode 3 (f=10,1348 Hz) | Vibration mode 57 (f=200,929 Hz) |
| Vibration mode 4 (f=10,7608 Hz) | Vibration mode 58 (f=213,278 Hz) |
| Vibration mode 5 (f=15,3401 Hz) | Vibration mode 59 (f=217,382 Hz) |
| Vibration mode 6 (f=15,3629 Hz) | Vibration mode 60 (f=222,276 Hz) |
| Vibration mode 7 (f=20,6574 Hz) | Vibration mode 61 (f=227,065 Hz) |
| Vibration mode 8 (f=21,9088 Hz) | Vibration mode 62 (f=234,594 Hz) |
| Vibration mode 9 (f=24,6942 Hz) | Vibration mode 63 (f=241,282 Hz) |
| Vibration mode 10 (f=26,2163 Hz) | Vibration mode 64 (f=241,751 Hz) |
| Vibration mode 11 (f=31,6882 Hz) | Vibration mode 65 (f=242,894 Hz) |
| Vibration mode 12 (f=32,5485 Hz) | Vibration mode 66 (f=255,914 Hz) |
| Vibration mode 13 (f=33,5983 Hz) | Vibration mode 67 (f=263,303 Hz) |
| Vibration mode 14 (f=33,7534 Hz) | Vibration mode 68 (f=268,352 Hz) |
| Vibration mode 15 (f=38,0123 Hz) | Vibration mode 69 (f=268,969 Hz) |
| Vibration mode 16 (f=42,959 Hz) | Vibration mode 70 (f=270,974 Hz) |
| Vibration mode 17 (f=44,4163 Hz) | Vibration mode 71 (f=286,423 Hz) |
| Vibration mode 18 (f=46,4136 Hz) | Vibration mode 72 (f=290,077 Hz) |
| Vibration mode 19 (f=50,9919 Hz) | Vibration mode 73 (f=291,658 Hz) |
| Vibration mode 20 (f=56,0656 Hz) | Vibration mode 74 (f=302,145 Hz) |
| Vibration mode 21 (f=58,0745 Hz) | Vibration mode 75 (f=302,383 Hz) |
| Vibration mode 22 (f=59,5532 Hz) | Vibration mode 76 (f=313,194 Hz) |
| Vibration mode 23 (f=64,9821 Hz) | Vibration mode 77 (f=318,457 Hz) |
| Vibration mode 24 (f=67,2701 Hz) | Vibration mode 78 (f=318,592 Hz) |
| Vibration mode 25 (f=70,9112 Hz) | Vibration mode 79 (f=334,997 Hz) |
| Vibration mode 26 (f=72,0251 Hz) | Vibration mode 80 (f=336,48 Hz) |
| Vibration mode 27 (f=73,2367 Hz) | Vibration mode 81 (f=340,818 Hz) |
| Vibration mode 28 (f=81,495 Hz) | Vibration mode 82 (f=343,92 Hz) |
| Vibration mode 29 (f=84,4985 Hz) | Vibration mode 83 (f=352,331 Hz) |
| Vibration mode 30 (f=87,1585 Hz) | Vibration mode 84 (f=366,388 Hz) |
| Vibration mode 31 (f=89,9795 Hz) | Vibration mode 85 (f=369,802 Hz) |
| Vibration mode 32 (f=99,088 Hz) | Vibration mode 86 (f=370,338 Hz) |
| Vibration mode 33 (f=99,9835 Hz) | Vibration mode 87 (f=371,032 Hz) |
| Vibration mode 34 (f=100,282 Hz) | Vibration mode 88 (f=387,754 Hz) |
| Vibration mode 35 (f=104,247 Hz) | Vibration mode 89 (f=394,907 Hz) |
| Vibration mode 36 (f=108,634 Hz) | Vibration mode 90 (f=398,504 Hz) |
| Vibration mode 37 (f=118,219 Hz) | Vibration mode 91 (f=404,051 Hz) |
| Vibration mode 38 (f=118,411 Hz) | Vibration mode 92 (f=406,494 Hz) |
| Vibration mode 39 (f=120,571 Hz) | Vibration mode 93 (f=422,308 Hz) |
| Vibration mode 40 (f=128,78 Hz) | Vibration mode 94 (f=424,608 Hz) |
| Vibration mode 41 (f=133,733 Hz) | Vibration mode 95 (f=426,682 Hz) |
| Vibration mode 42 (f=135,639 Hz) | Vibration mode 96 (f=438,927 Hz) |
| Vibration mode 43 (f=138,216 Hz) | Vibration mode 97 (f=443,739 Hz) |
| Vibration mode 44 (f=139,623 Hz) | Vibration mode 98 (f=452,136 Hz) |
| Vibration mode 45 (f=150,726 Hz) | Vibration mode 99 (f=455,435 Hz) |
| Vibration mode 46 (f=153,932 Hz) | Vibration mode 100 (f=463,249 Hz) |
| Vibration mode 47 (f=158,863 Hz) | Vibration mode 101 (f=473,234 Hz) |
| Vibration mode 48 (f=162,388 Hz) | Vibration mode 102 (f=480,711 Hz) |
| Vibration mode 49 (f=167,306 Hz) | Vibration mode 103 (f=483,254 Hz) |
| Vibration mode 50 (f=174,491 Hz) | Vibration mode 104 (f=485,284 Hz) |
| Vibration mode 51 (f=175,731 Hz) | Vibration mode 105 (f=502,894 Hz) |
| Vibration mode 52 (f=177,678 Hz) | Vibration mode 106 (f=508,443 Hz) |
| Vibration mode 53 (f=186,959 Hz) | Vibration mode 107 (f=512,335 Hz) |
| Vibration mode 54 (f=195,226 Hz) | Vibration mode 108 (f=514,626 Hz) |

Vibration mode 109 (f=523,867 Hz)
 Vibration mode 110 (f=541,638 Hz)
 Vibration mode 111 (f=542,826 Hz)
 Vibration mode 112 (f=545,005 Hz)
 Vibration mode 113 (f=546,601 Hz)
 Vibration mode 114 (f=566,516 Hz)
 Vibration mode 115 (f=575,148 Hz)
 Vibration mode 116 (f=576,201 Hz)
 Vibration mode 117 (f=577,501 Hz)
 Vibration mode 118 (f=588,575 Hz)
 Vibration mode 119 (f=605,311 Hz)
 Vibration mode 120 (f=609,366 Hz)
 Vibration mode 121 (f=610,247 Hz)
 Vibration mode 122 (f=614,004 Hz)
 Vibration mode 123 (f=632,882 Hz)
 Vibration mode 124 (f=638,999 Hz)
 Vibration mode 125 (f=641,671 Hz)
 Vibration mode 126 (f=648,34 Hz)
 Vibration mode 127 (f=656,081 Hz)
 Vibration mode 128 (f=671,954 Hz)
 Vibration mode 129 (f=675,703 Hz)
 Vibration mode 130 (f=679,624 Hz)
 Vibration mode 131 (f=683,543 Hz)
 Vibration mode 132 (f=703,643 Hz)
 Vibration mode 133 (f=705,073 Hz)
 Vibration mode 134 (f=710,022 Hz)
 Vibration mode 135 (f=718,694 Hz)
 Vibration mode 136 (f=728,346 Hz)
 Vibration mode 137 (f=740,974 Hz)
 Vibration mode 138 (f=743,258 Hz)

Vibration mode 139 (f=750,827 Hz)
 Vibration mode 140 (f=756,694 Hz)
 Vibration mode 141 (f=774,574 Hz)
 Vibration mode 142 (f=777,006 Hz)
 Vibration mode 143 (f=780,049 Hz)
 Vibration mode 144 (f=791,613 Hz)
 Vibration mode 145 (f=802,779 Hz)
 Vibration mode 146 (f=810,173 Hz)
 Vibration mode 147 (f=815,411 Hz)
 Vibration mode 148 (f=827,52 Hz)
 Vibration mode 149 (f=828,913 Hz)
 Vibration mode 150 (f=847,597 Hz)
 Vibration mode 151 (f=850,94 Hz)
 Vibration mode 152 (f=855,409 Hz)
 Vibration mode 153 (f=863,745 Hz)
 Vibration mode 154 (f=882,471 Hz)
 Vibration mode 155 (f=882,495 Hz)
 Vibration mode 156 (f=889,914 Hz)
 Vibration mode 157 (f=899,838 Hz)
 Vibration mode 158 (f=910,317 Hz)
 Vibration mode 159 (f=920,36 Hz)
 Vibration mode 160 (f=926,434 Hz)
 Vibration mode 161 (f=934,114 Hz)
 Vibration mode 162 (f=940,677 Hz)
 Vibration mode 163 (f=959,547 Hz)
 Vibration mode 164 (f=964,145 Hz)
 Vibration mode 165 (f=964,155 Hz)
 Vibration mode 166 (f=975,971 Hz)
 Vibration mode 167 (f=993,235 Hz)
 Vibration mode 168 (f=995,596 Hz)

Frecuencia: [0 Hz ; 500 Hz]

Tabla 2. Frecuencia en cada nodo.

Vibration mode 1 (f=5,06322 Hz)
 Vibration mode 2 (f=5,14098 Hz)
 Vibration mode 3 (f=10,1348 Hz)
 Vibration mode 4 (f=10,7608 Hz)
 Vibration mode 5 (f=15,3401 Hz)
 Vibration mode 6 (f=15,3629 Hz)
 Vibration mode 7 (f=20,6574 Hz)
 Vibration mode 8 (f=21,9088 Hz)
 Vibration mode 9 (f=24,6942 Hz)
 Vibration mode 10 (f=26,2163 Hz)
 Vibration mode 11 (f=31,6882 Hz)
 Vibration mode 12 (f=32,5485 Hz)
 Vibration mode 13 (f=33,5983 Hz)
 Vibration mode 14 (f=33,7534 Hz)
 Vibration mode 15 (f=38,0123 Hz)
 Vibration mode 16 (f=42,959 Hz)
 Vibration mode 17 (f=44,4163 Hz)
 Vibration mode 18 (f=46,4136 Hz)
 Vibration mode 19 (f=50,9919 Hz)
 Vibration mode 20 (f=56,0656 Hz)
 Vibration mode 21 (f=58,0745 Hz)
 Vibration mode 22 (f=59,5532 Hz)
 Vibration mode 23 (f=64,9821 Hz)
 Vibration mode 24 (f=67,2701 Hz)
 Vibration mode 25 (f=70,9112 Hz)

Vibration mode 26 (f=72,0251 Hz)
 Vibration mode 27 (f=73,2367 Hz)
 Vibration mode 28 (f=81,495 Hz)
 Vibration mode 29 (f=84,4985 Hz)
 Vibration mode 30 (f=87,1585 Hz)
 Vibration mode 31 (f=89,9795 Hz)
 Vibration mode 32 (f=99,088 Hz)
 Vibration mode 33 (f=99,9835 Hz)
 Vibration mode 34 (f=100,282 Hz)
 Vibration mode 35 (f=104,247 Hz)
 Vibration mode 36 (f=108,634 Hz)
 Vibration mode 37 (f=118,219 Hz)
 Vibration mode 38 (f=118,411 Hz)
 Vibration mode 39 (f=120,571 Hz)
 Vibration mode 40 (f=128,78 Hz)
 Vibration mode 41 (f=133,733 Hz)
 Vibration mode 42 (f=135,639 Hz)
 Vibration mode 43 (f=138,216 Hz)
 Vibration mode 44 (f=139,623 Hz)
 Vibration mode 45 (f=150,726 Hz)
 Vibration mode 46 (f=153,932 Hz)
 Vibration mode 47 (f=158,863 Hz)
 Vibration mode 48 (f=162,388 Hz)
 Vibration mode 49 (f=167,306 Hz)
 Vibration mode 50 (f=174,491 Hz)

Vibration mode 51 (f=175,731 Hz)
 Vibration mode 52 (f=177,678 Hz)
 Vibration mode 53 (f=186,959 Hz)
 Vibration mode 54 (f=195,226 Hz)
 Vibration mode 55 (f=199,245 Hz)
 Vibration mode 56 (f=199,901 Hz)
 Vibration mode 57 (f=200,929 Hz)
 Vibration mode 58 (f=213,278 Hz)
 Vibration mode 59 (f=217,382 Hz)
 Vibration mode 60 (f=222,276 Hz)
 Vibration mode 61 (f=227,065 Hz)
 Vibration mode 62 (f=234,594 Hz)
 Vibration mode 63 (f=241,282 Hz)
 Vibration mode 64 (f=241,751 Hz)
 Vibration mode 65 (f=242,894 Hz)
 Vibration mode 66 (f=255,914 Hz)
 Vibration mode 67 (f=263,303 Hz)
 Vibration mode 68 (f=268,352 Hz)
 Vibration mode 69 (f=268,969 Hz)
 Vibration mode 70 (f=270,974 Hz)
 Vibration mode 71 (f=286,423 Hz)
 Vibration mode 72 (f=290,077 Hz)
 Vibration mode 73 (f=291,658 Hz)
 Vibration mode 74 (f=302,145 Hz)
 Vibration mode 75 (f=302,383 Hz)
 Vibration mode 76 (f=313,194 Hz)
 Vibration mode 77 (f=318,457 Hz)

Vibration mode 78 (f=318,592 Hz)
 Vibration mode 79 (f=334,997 Hz)
 Vibration mode 80 (f=336,48 Hz)
 Vibration mode 81 (f=340,818 Hz)
 Vibration mode 82 (f=343,92 Hz)
 Vibration mode 83 (f=352,331 Hz)
 Vibration mode 84 (f=366,388 Hz)
 Vibration mode 85 (f=369,802 Hz)
 Vibration mode 86 (f=370,338 Hz)
 Vibration mode 87 (f=371,032 Hz)
 Vibration mode 88 (f=387,754 Hz)
 Vibration mode 89 (f=394,907 Hz)
 Vibration mode 90 (f=398,504 Hz)
 Vibration mode 91 (f=404,051 Hz)
 Vibration mode 92 (f=406,494 Hz)
 Vibration mode 93 (f=422,308 Hz)
 Vibration mode 94 (f=424,608 Hz)
 Vibration mode 95 (f=426,682 Hz)
 Vibration mode 96 (f=438,927 Hz)
 Vibration mode 97 (f=443,739 Hz)
 Vibration mode 98 (f=452,136 Hz)
 Vibration mode 99 (f=455,435 Hz)
 Vibration mode 100 (f=463,249 Hz)
 Vibration mode 101 (f=473,234 Hz)
 Vibration mode 102 (f=480,711 Hz)
 Vibration mode 103 (f=483,254 Hz)
 Vibration mode 104 (f=485,284 Hz)

Frecuencia: [250 Hz ; 750 Hz]

Tabla 3. Frecuencia en cada nodo.

Vibration mode 1 (f=255,914 Hz)
 Vibration mode 2 (f=263,303 Hz)
 Vibration mode 3 (f=268,352 Hz)
 Vibration mode 4 (f=268,969 Hz)
 Vibration mode 5 (f=270,974 Hz)
 Vibration mode 6 (f=286,423 Hz)
 Vibration mode 7 (f=290,077 Hz)
 Vibration mode 8 (f=291,658 Hz)
 Vibration mode 9 (f=302,145 Hz)
 Vibration mode 10 (f=302,383 Hz)
 Vibration mode 11 (f=313,194 Hz)
 Vibration mode 12 (f=318,457 Hz)
 Vibration mode 13 (f=318,592 Hz)
 Vibration mode 14 (f=334,997 Hz)
 Vibration mode 15 (f=336,48 Hz)
 Vibration mode 16 (f=340,818 Hz)
 Vibration mode 17 (f=343,92 Hz)
 Vibration mode 18 (f=352,331 Hz)
 Vibration mode 19 (f=366,388 Hz)
 Vibration mode 20 (f=369,802 Hz)
 Vibration mode 21 (f=370,338 Hz)
 Vibration mode 22 (f=371,032 Hz)
 Vibration mode 23 (f=387,754 Hz)
 Vibration mode 24 (f=394,907 Hz)
 Vibration mode 25 (f=398,504 Hz)
 Vibration mode 26 (f=404,051 Hz)
 Vibration mode 27 (f=406,494 Hz)
 Vibration mode 28 (f=422,308 Hz)
 Vibration mode 29 (f=424,608 Hz)
 Vibration mode 30 (f=426,682 Hz)

Vibration mode 31 (f=438,927 Hz)
 Vibration mode 32 (f=443,739 Hz)
 Vibration mode 33 (f=452,136 Hz)
 Vibration mode 34 (f=455,435 Hz)
 Vibration mode 35 (f=463,249 Hz)
 Vibration mode 36 (f=473,234 Hz)
 Vibration mode 37 (f=480,711 Hz)
 Vibration mode 38 (f=483,254 Hz)
 Vibration mode 39 (f=485,284 Hz)
 Vibration mode 40 (f=502,894 Hz)
 Vibration mode 41 (f=508,443 Hz)
 Vibration mode 42 (f=512,335 Hz)
 Vibration mode 43 (f=514,626 Hz)
 Vibration mode 44 (f=523,867 Hz)
 Vibration mode 45 (f=541,638 Hz)
 Vibration mode 46 (f=542,826 Hz)
 Vibration mode 47 (f=545,005 Hz)
 Vibration mode 48 (f=546,601 Hz)
 Vibration mode 49 (f=566,516 Hz)
 Vibration mode 50 (f=575,148 Hz)
 Vibration mode 51 (f=576,201 Hz)
 Vibration mode 52 (f=577,501 Hz)
 Vibration mode 53 (f=588,575 Hz)
 Vibration mode 54 (f=605,311 Hz)
 Vibration mode 55 (f=609,366 Hz)
 Vibration mode 56 (f=610,247 Hz)
 Vibration mode 57 (f=614,004 Hz)
 Vibration mode 58 (f=632,882 Hz)
 Vibration mode 59 (f=638,999 Hz)
 Vibration mode 60 (f=641,671 Hz)

Vibration mode 61 (f=648,34 Hz)
 Vibration mode 62 (f=656,081 Hz)
 Vibration mode 63 (f=671,954 Hz)
 Vibration mode 64 (f=675,703 Hz)
 Vibration mode 65 (f=679,624 Hz)
 Vibration mode 66 (f=683,543 Hz)
 Vibration mode 67 (f=703,643 Hz)

Vibration mode 68 (f=705,073 Hz)
 Vibration mode 69 (f=710,022 Hz)
 Vibration mode 70 (f=718,694 Hz)
 Vibration mode 71 (f=728,346 Hz)
 Vibration mode 72 (f=740,974 Hz)
 Vibration mode 73 (f=743,258 Hz)

4. Análisis de la respuesta armónica

La aceleración armónica del archivo acceleration.txt es la siguiente (La frecuencia está en Hz y la aceleración en mm/s²):

Tabla 4. Aceleración armónica

| Freq | Acceleration_X | Acceleration_Y | Acceleration_Z | Freq | Acceleration_X | Acceleration_Y | Acceleration_Z |
|----------|----------------|----------------|----------------|----------|----------------|----------------|----------------|
| 2.50E+01 | 4.60E+03 | 1.56E+03 | 3.26E+03 | 3.55E+02 | 7.12E+03 | 9.44E+03 | 2.54E+04 |
| 2.60E+01 | 4.64E+03 | 1.56E+03 | 3.30E+03 | 3.56E+02 | 7.28E+03 | 9.92E+03 | 2.56E+04 |
| 2.70E+01 | 4.68E+03 | 1.56E+03 | 3.34E+03 | 3.57E+02 | 7.44E+03 | 1.04E+04 | 2.58E+04 |
| 2.80E+01 | 4.72E+03 | 1.56E+03 | 3.38E+03 | 3.58E+02 | 7.60E+03 | 1.09E+04 | 2.60E+04 |
| 2.90E+01 | 4.76E+03 | 1.56E+03 | 3.42E+03 | 3.59E+02 | 7.84E+03 | 1.13E+04 | 2.62E+04 |
| 3.00E+01 | 4.80E+03 | 1.56E+03 | 3.46E+03 | 3.60E+02 | 8.08E+03 | 1.17E+04 | 2.65E+04 |
| 3.10E+01 | 4.84E+03 | 1.56E+03 | 3.50E+03 | 3.61E+02 | 8.32E+03 | 1.22E+04 | 2.69E+04 |
| 3.20E+01 | 4.88E+03 | 1.56E+03 | 3.54E+03 | 3.62E+02 | 8.56E+03 | 1.26E+04 | 2.72E+04 |
| 3.30E+01 | 4.92E+03 | 1.56E+03 | 3.58E+03 | 3.63E+02 | 8.80E+03 | 1.30E+04 | 2.75E+04 |
| 3.40E+01 | 4.92E+03 | 1.53E+03 | 3.60E+03 | 3.64E+02 | 9.04E+03 | 1.34E+04 | 2.78E+04 |
| 3.50E+01 | 4.92E+03 | 1.49E+03 | 3.60E+03 | 3.65E+02 | 9.28E+03 | 1.38E+04 | 2.82E+04 |
| 3.60E+01 | 4.88E+03 | 1.45E+03 | 3.60E+03 | 3.66E+02 | 9.56E+03 | 1.42E+04 | 2.85E+04 |
| 3.70E+01 | 4.88E+03 | 1.41E+03 | 3.60E+03 | 3.67E+02 | 9.84E+03 | 1.46E+04 | 2.89E+04 |
| 3.80E+01 | 4.84E+03 | 1.37E+03 | 3.60E+03 | 3.68E+02 | 1.02E+04 | 1.50E+04 | 2.95E+04 |
| 3.90E+01 | 4.84E+03 | 1.33E+03 | 3.60E+03 | 3.69E+02 | 1.06E+04 | 1.54E+04 | 3.01E+04 |
| 4.00E+01 | 4.80E+03 | 1.29E+03 | 3.60E+03 | 3.70E+02 | 1.11E+04 | 1.58E+04 | 3.08E+04 |
| 4.10E+01 | 4.80E+03 | 1.24E+03 | 3.60E+03 | 3.71E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 4.20E+01 | 4.76E+03 | 1.20E+03 | 3.60E+03 | 3.72E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 4.30E+01 | 4.76E+03 | 1.16E+03 | 3.60E+03 | 3.73E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 4.40E+01 | 4.72E+03 | 1.12E+03 | 3.60E+03 | 3.74E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 4.50E+01 | 4.72E+03 | 1.08E+03 | 3.60E+03 | 3.75E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 4.60E+01 | 4.68E+03 | 1.04E+03 | 3.60E+03 | 3.76E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 4.70E+01 | 4.68E+03 | 1.00E+03 | 3.60E+03 | 3.77E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 4.80E+01 | 4.64E+03 | 9.60E+02 | 3.60E+03 | 3.78E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 4.90E+01 | 4.64E+03 | 9.20E+02 | 3.60E+03 | 3.79E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 5.00E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.80E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 5.10E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.81E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 5.20E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.82E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 5.30E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.83E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 |
| 5.40E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.84E+02 | 4.96E+03 | 9.04E+02 | 2.92E+03 |
| 5.50E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.85E+02 | 4.96E+03 | 9.48E+02 | 2.92E+03 |
| 5.60E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.86E+02 | 4.96E+03 | 9.88E+02 | 2.92E+03 |
| 5.70E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.87E+02 | 4.96E+03 | 1.03E+03 | 2.92E+03 |
| 5.80E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.88E+02 | 4.96E+03 | 1.07E+03 | 2.92E+03 |

| | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 5.90E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.89E+02 | 4.96E+03 | 1.11E+03 | 2.92E+03 |
| 6.00E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.90E+02 | 4.96E+03 | 1.15E+03 | 2.92E+03 |
| 6.10E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.91E+02 | 4.96E+03 | 1.19E+03 | 2.92E+03 |
| 6.20E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.92E+02 | 4.96E+03 | 1.23E+03 | 2.92E+03 |
| 6.30E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.93E+02 | 4.96E+03 | 1.27E+03 | 2.92E+03 |
| 6.40E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.94E+02 | 4.96E+03 | 1.31E+03 | 2.92E+03 |
| 6.50E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.95E+02 | 4.96E+03 | 1.35E+03 | 2.92E+03 |
| 6.60E+01 | 4.60E+03 | 8.80E+02 | 3.60E+03 | 3.96E+02 | 4.96E+03 | 1.40E+03 | 2.92E+03 |
| 6.70E+01 | 4.60E+03 | 8.92E+02 | 3.60E+03 | 3.97E+02 | 4.96E+03 | 1.44E+03 | 2.92E+03 |
| 6.80E+01 | 4.60E+03 | 9.32E+02 | 3.60E+03 | 3.98E+02 | 4.96E+03 | 1.48E+03 | 2.92E+03 |
| 6.90E+01 | 4.56E+03 | 9.72E+02 | 3.60E+03 | 3.99E+02 | 4.96E+03 | 1.52E+03 | 2.92E+03 |
| 7.00E+01 | 4.56E+03 | 1.02E+03 | 3.60E+03 | 4.00E+02 | 4.96E+03 | 1.56E+03 | 2.92E+03 |
| 7.10E+01 | 4.52E+03 | 1.06E+03 | 3.60E+03 | 4.01E+02 | 4.92E+03 | 1.56E+03 | 2.92E+03 |
| 7.20E+01 | 4.52E+03 | 1.10E+03 | 3.60E+03 | 4.02E+02 | 4.88E+03 | 1.56E+03 | 2.92E+03 |
| 7.30E+01 | 4.48E+03 | 1.14E+03 | 3.60E+03 | 4.03E+02 | 4.84E+03 | 1.56E+03 | 2.92E+03 |
| 7.40E+01 | 4.48E+03 | 1.18E+03 | 3.60E+03 | 4.04E+02 | 4.80E+03 | 1.56E+03 | 2.92E+03 |
| 7.50E+01 | 4.44E+03 | 1.22E+03 | 3.60E+03 | 4.05E+02 | 4.76E+03 | 1.56E+03 | 2.92E+03 |
| 7.60E+01 | 4.44E+03 | 1.26E+03 | 3.60E+03 | 4.06E+02 | 4.72E+03 | 1.56E+03 | 2.92E+03 |
| 7.70E+01 | 4.40E+03 | 1.30E+03 | 3.60E+03 | 4.07E+02 | 4.68E+03 | 1.56E+03 | 2.92E+03 |
| 7.80E+01 | 4.40E+03 | 1.34E+03 | 3.60E+03 | 4.08E+02 | 4.64E+03 | 1.56E+03 | 2.92E+03 |
| 7.90E+01 | 4.36E+03 | 1.38E+03 | 3.60E+03 | 4.09E+02 | 4.60E+03 | 1.56E+03 | 2.92E+03 |
| 8.00E+01 | 4.36E+03 | 1.42E+03 | 3.60E+03 | 4.10E+02 | 4.56E+03 | 1.56E+03 | 2.92E+03 |
| 8.10E+01 | 4.32E+03 | 1.46E+03 | 3.60E+03 | 4.11E+02 | 4.52E+03 | 1.56E+03 | 2.92E+03 |
| 8.20E+01 | 4.32E+03 | 1.50E+03 | 3.60E+03 | 4.12E+02 | 4.48E+03 | 1.56E+03 | 2.92E+03 |
| 8.30E+01 | 4.28E+03 | 1.54E+03 | 3.60E+03 | 4.13E+02 | 4.44E+03 | 1.56E+03 | 2.92E+03 |
| 8.40E+01 | 4.24E+03 | 1.56E+03 | 3.60E+03 | 4.14E+02 | 4.40E+03 | 1.56E+03 | 2.92E+03 |
| 8.50E+01 | 4.20E+03 | 1.56E+03 | 3.60E+03 | 4.15E+02 | 4.36E+03 | 1.56E+03 | 2.92E+03 |
| 8.60E+01 | 4.16E+03 | 1.56E+03 | 3.60E+03 | 4.16E+02 | 4.32E+03 | 1.56E+03 | 2.92E+03 |
| 8.70E+01 | 4.12E+03 | 1.56E+03 | 3.60E+03 | 4.17E+02 | 4.28E+03 | 1.56E+03 | 2.93E+03 |
| 8.80E+01 | 4.08E+03 | 1.56E+03 | 3.60E+03 | 4.18E+02 | 4.32E+03 | 1.56E+03 | 2.97E+03 |
| 8.90E+01 | 4.04E+03 | 1.56E+03 | 3.60E+03 | 4.19E+02 | 4.36E+03 | 1.56E+03 | 3.01E+03 |
| 9.00E+01 | 4.00E+03 | 1.56E+03 | 3.60E+03 | 4.20E+02 | 4.40E+03 | 1.56E+03 | 3.05E+03 |
| 9.10E+01 | 3.96E+03 | 1.56E+03 | 3.60E+03 | 4.21E+02 | 4.44E+03 | 1.56E+03 | 3.09E+03 |
| 9.20E+01 | 3.92E+03 | 1.56E+03 | 3.60E+03 | 4.22E+02 | 4.48E+03 | 1.56E+03 | 3.13E+03 |
| 9.30E+01 | 3.88E+03 | 1.56E+03 | 3.60E+03 | 4.23E+02 | 4.52E+03 | 1.56E+03 | 3.17E+03 |
| 9.40E+01 | 3.84E+03 | 1.56E+03 | 3.60E+03 | 4.24E+02 | 4.56E+03 | 1.56E+03 | 3.21E+03 |
| 9.50E+01 | 3.80E+03 | 1.56E+03 | 3.60E+03 | 4.25E+02 | 3.60E+03 | 2.24E+03 | 2.92E+03 |
| 9.60E+01 | 3.76E+03 | 1.56E+03 | 3.60E+03 | 4.26E+02 | 3.60E+03 | 2.21E+03 | 2.92E+03 |
| 9.70E+01 | 3.72E+03 | 1.56E+03 | 3.60E+03 | 4.27E+02 | 3.60E+03 | 2.18E+03 | 2.92E+03 |
| 9.80E+01 | 3.68E+03 | 1.56E+03 | 3.60E+03 | 4.28E+02 | 3.60E+03 | 2.16E+03 | 2.92E+03 |
| 9.90E+01 | 3.64E+03 | 1.56E+03 | 3.60E+03 | 4.29E+02 | 3.60E+03 | 2.13E+03 | 2.92E+03 |
| 1.00E+02 | 3.60E+03 | 1.56E+03 | 3.60E+03 | 4.30E+02 | 3.60E+03 | 2.10E+03 | 2.92E+03 |
| 1.01E+02 | 3.55E+03 | 1.52E+03 | 3.68E+03 | 4.31E+02 | 3.60E+03 | 2.07E+03 | 2.92E+03 |
| 1.02E+02 | 3.51E+03 | 1.48E+03 | 3.76E+03 | 4.32E+02 | 3.60E+03 | 2.05E+03 | 2.92E+03 |
| 1.03E+02 | 3.47E+03 | 1.44E+03 | 3.84E+03 | 4.33E+02 | 3.60E+03 | 2.02E+03 | 2.92E+03 |
| 1.04E+02 | 3.43E+03 | 1.40E+03 | 3.92E+03 | 4.34E+02 | 3.60E+03 | 1.99E+03 | 2.92E+03 |
| 1.05E+02 | 3.39E+03 | 1.35E+03 | 4.00E+03 | 4.35E+02 | 3.60E+03 | 1.96E+03 | 2.92E+03 |
| 1.06E+02 | 3.35E+03 | 1.31E+03 | 4.08E+03 | 4.36E+02 | 3.60E+03 | 1.94E+03 | 2.92E+03 |
| 1.07E+02 | 3.31E+03 | 1.27E+03 | 4.16E+03 | 4.37E+02 | 3.60E+03 | 1.91E+03 | 2.92E+03 |
| 1.08E+02 | 3.27E+03 | 1.23E+03 | 4.24E+03 | 4.38E+02 | 3.60E+03 | 1.88E+03 | 2.92E+03 |

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|----------|----------|----------|----------|----------|----------|----------|----------|
| 1.09E+02 | 3.23E+03 | 1.19E+03 | 4.32E+03 | 4.39E+02 | 3.60E+03 | 1.86E+03 | 2.92E+03 |
| 1.10E+02 | 3.19E+03 | 1.15E+03 | 4.40E+03 | 4.40E+02 | 3.60E+03 | 1.83E+03 | 2.92E+03 |
| 1.11E+02 | 3.15E+03 | 1.11E+03 | 4.48E+03 | 4.41E+02 | 3.60E+03 | 1.80E+03 | 2.92E+03 |
| 1.12E+02 | 3.10E+03 | 1.07E+03 | 4.56E+03 | 4.42E+02 | 3.60E+03 | 1.78E+03 | 2.92E+03 |
| 1.13E+02 | 3.06E+03 | 1.03E+03 | 4.64E+03 | 4.43E+02 | 3.60E+03 | 1.75E+03 | 2.92E+03 |
| 1.14E+02 | 3.02E+03 | 9.88E+02 | 4.72E+03 | 4.44E+02 | 3.60E+03 | 1.72E+03 | 2.92E+03 |
| 1.15E+02 | 2.98E+03 | 9.48E+02 | 4.80E+03 | 4.45E+02 | 3.60E+03 | 1.69E+03 | 2.92E+03 |
| 1.16E+02 | 2.94E+03 | 9.04E+02 | 4.88E+03 | 4.46E+02 | 3.60E+03 | 1.67E+03 | 2.92E+03 |
| 1.17E+02 | 2.89E+03 | 8.92E+02 | 4.96E+03 | 4.47E+02 | 3.60E+03 | 1.64E+03 | 2.92E+03 |
| 1.18E+02 | 2.81E+03 | 9.32E+02 | 5.00E+03 | 4.48E+02 | 3.60E+03 | 1.61E+03 | 2.92E+03 |
| 1.19E+02 | 2.72E+03 | 9.72E+02 | 5.04E+03 | 4.49E+02 | 3.60E+03 | 1.58E+03 | 2.92E+03 |
| 1.20E+02 | 2.64E+03 | 1.02E+03 | 5.08E+03 | 4.50E+02 | 3.60E+03 | 1.56E+03 | 2.92E+03 |
| 1.21E+02 | 2.56E+03 | 1.06E+03 | 5.12E+03 | 4.51E+02 | 3.60E+03 | 1.53E+03 | 2.89E+03 |
| 1.22E+02 | 2.48E+03 | 1.10E+03 | 5.16E+03 | 4.52E+02 | 3.60E+03 | 1.50E+03 | 2.86E+03 |
| 1.23E+02 | 2.40E+03 | 1.14E+03 | 5.20E+03 | 4.53E+02 | 3.60E+03 | 1.48E+03 | 2.83E+03 |
| 1.24E+02 | 2.32E+03 | 1.18E+03 | 5.24E+03 | 4.54E+02 | 3.60E+03 | 1.45E+03 | 2.81E+03 |
| 1.25E+02 | 2.24E+03 | 1.22E+03 | 5.28E+03 | 4.55E+02 | 3.60E+03 | 1.42E+03 | 2.78E+03 |
| 1.26E+02 | 2.16E+03 | 1.26E+03 | 5.32E+03 | 4.56E+02 | 3.60E+03 | 1.40E+03 | 2.75E+03 |
| 1.27E+02 | 2.07E+03 | 1.30E+03 | 5.36E+03 | 4.57E+02 | 3.60E+03 | 1.37E+03 | 2.72E+03 |
| 1.28E+02 | 1.99E+03 | 1.34E+03 | 5.40E+03 | 4.58E+02 | 3.60E+03 | 1.34E+03 | 2.70E+03 |
| 1.29E+02 | 1.91E+03 | 1.38E+03 | 5.44E+03 | 4.59E+02 | 3.60E+03 | 1.31E+03 | 2.67E+03 |
| 1.30E+02 | 1.83E+03 | 1.42E+03 | 5.48E+03 | 4.60E+02 | 3.60E+03 | 1.29E+03 | 2.64E+03 |
| 1.31E+02 | 1.75E+03 | 1.46E+03 | 5.52E+03 | 4.61E+02 | 3.60E+03 | 1.26E+03 | 2.62E+03 |
| 1.32E+02 | 1.67E+03 | 1.50E+03 | 5.56E+03 | 4.62E+02 | 3.60E+03 | 1.23E+03 | 2.59E+03 |
| 1.33E+02 | 1.58E+03 | 1.54E+03 | 5.60E+03 | 4.63E+02 | 3.60E+03 | 1.20E+03 | 2.56E+03 |
| 1.34E+02 | 1.76E+03 | 1.62E+03 | 5.68E+03 | 4.64E+02 | 3.60E+03 | 1.18E+03 | 2.54E+03 |
| 1.35E+02 | 2.07E+03 | 1.73E+03 | 5.80E+03 | 4.65E+02 | 3.60E+03 | 1.15E+03 | 2.51E+03 |
| 1.36E+02 | 2.37E+03 | 1.83E+03 | 5.92E+03 | 4.66E+02 | 3.60E+03 | 1.12E+03 | 2.48E+03 |
| 1.37E+02 | 2.68E+03 | 1.93E+03 | 6.00E+03 | 4.67E+02 | 3.60E+03 | 1.10E+03 | 2.45E+03 |
| 1.38E+02 | 2.98E+03 | 2.03E+03 | 6.12E+03 | 4.68E+02 | 3.60E+03 | 1.07E+03 | 2.43E+03 |
| 1.39E+02 | 3.29E+03 | 2.14E+03 | 6.20E+03 | 4.69E+02 | 3.60E+03 | 1.04E+03 | 2.40E+03 |
| 1.40E+02 | 3.60E+03 | 2.24E+03 | 6.32E+03 | 4.70E+02 | 3.60E+03 | 1.02E+03 | 2.37E+03 |
| 1.41E+02 | 1.34E+03 | 1.19E+03 | 2.92E+03 | 4.71E+02 | 3.60E+03 | 9.88E+02 | 2.34E+03 |
| 1.42E+02 | 1.33E+03 | 1.23E+03 | 2.92E+03 | 4.72E+02 | 3.60E+03 | 9.60E+02 | 2.32E+03 |
| 1.43E+02 | 1.31E+03 | 1.27E+03 | 2.92E+03 | 4.73E+02 | 3.60E+03 | 9.32E+02 | 2.29E+03 |
| 1.44E+02 | 1.30E+03 | 1.31E+03 | 2.92E+03 | 4.74E+02 | 3.60E+03 | 9.04E+02 | 2.26E+03 |
| 1.45E+02 | 1.29E+03 | 1.35E+03 | 2.92E+03 | 4.75E+02 | 3.60E+03 | 8.80E+02 | 2.24E+03 |
| 1.46E+02 | 1.27E+03 | 1.40E+03 | 2.92E+03 | 4.76E+02 | 3.60E+03 | 9.04E+02 | 2.21E+03 |
| 1.47E+02 | 1.26E+03 | 1.44E+03 | 2.92E+03 | 4.77E+02 | 3.60E+03 | 9.32E+02 | 2.18E+03 |
| 1.48E+02 | 1.24E+03 | 1.48E+03 | 2.92E+03 | 4.78E+02 | 3.60E+03 | 9.60E+02 | 2.16E+03 |
| 1.49E+02 | 1.23E+03 | 1.52E+03 | 2.92E+03 | 4.79E+02 | 3.60E+03 | 9.88E+02 | 2.13E+03 |
| 1.50E+02 | 1.22E+03 | 1.56E+03 | 2.92E+03 | 4.80E+02 | 3.60E+03 | 1.02E+03 | 2.10E+03 |
| 1.51E+02 | 1.23E+03 | 1.53E+03 | 2.92E+03 | 4.81E+02 | 3.60E+03 | 1.04E+03 | 2.07E+03 |
| 1.52E+02 | 1.24E+03 | 1.50E+03 | 2.92E+03 | 4.82E+02 | 3.60E+03 | 1.07E+03 | 2.05E+03 |
| 1.53E+02 | 1.26E+03 | 1.48E+03 | 2.92E+03 | 4.83E+02 | 3.60E+03 | 1.10E+03 | 2.02E+03 |
| 1.54E+02 | 1.27E+03 | 1.45E+03 | 2.92E+03 | 4.84E+02 | 3.60E+03 | 1.12E+03 | 1.99E+03 |
| 1.55E+02 | 1.29E+03 | 1.42E+03 | 2.92E+03 | 4.85E+02 | 3.60E+03 | 1.15E+03 | 1.96E+03 |
| 1.56E+02 | 1.30E+03 | 1.40E+03 | 2.92E+03 | 4.86E+02 | 3.60E+03 | 1.18E+03 | 1.94E+03 |
| 1.57E+02 | 1.31E+03 | 1.37E+03 | 2.92E+03 | 4.87E+02 | 3.60E+03 | 1.20E+03 | 1.91E+03 |
| 1.58E+02 | 1.33E+03 | 1.34E+03 | 2.92E+03 | 4.88E+02 | 3.60E+03 | 1.23E+03 | 1.88E+03 |

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|----------|----------|----------|----------|----------|----------|----------|----------|
| 1.59E+02 | 1.34E+03 | 1.31E+03 | 2.92E+03 | 4.89E+02 | 3.60E+03 | 1.26E+03 | 1.86E+03 |
| 1.60E+02 | 1.35E+03 | 1.29E+03 | 2.92E+03 | 4.90E+02 | 3.60E+03 | 1.29E+03 | 1.83E+03 |
| 1.61E+02 | 1.37E+03 | 1.26E+03 | 2.92E+03 | 4.91E+02 | 3.60E+03 | 1.31E+03 | 1.80E+03 |
| 1.62E+02 | 1.38E+03 | 1.23E+03 | 2.92E+03 | 4.92E+02 | 3.60E+03 | 1.34E+03 | 1.78E+03 |
| 1.63E+02 | 1.40E+03 | 1.20E+03 | 2.92E+03 | 4.93E+02 | 3.60E+03 | 1.37E+03 | 1.75E+03 |
| 1.64E+02 | 1.41E+03 | 1.18E+03 | 2.92E+03 | 4.94E+02 | 3.60E+03 | 1.40E+03 | 1.72E+03 |
| 1.65E+02 | 1.42E+03 | 1.15E+03 | 2.92E+03 | 4.95E+02 | 3.60E+03 | 1.42E+03 | 1.69E+03 |
| 1.66E+02 | 1.44E+03 | 1.12E+03 | 2.92E+03 | 4.96E+02 | 3.60E+03 | 1.45E+03 | 1.67E+03 |
| 1.67E+02 | 1.45E+03 | 1.10E+03 | 2.92E+03 | 4.97E+02 | 3.60E+03 | 1.48E+03 | 1.64E+03 |
| 1.68E+02 | 1.46E+03 | 1.07E+03 | 2.92E+03 | 4.98E+02 | 3.60E+03 | 1.50E+03 | 1.61E+03 |
| 1.69E+02 | 1.48E+03 | 1.04E+03 | 2.92E+03 | 4.99E+02 | 3.60E+03 | 1.53E+03 | 1.58E+03 |
| 1.70E+02 | 1.49E+03 | 1.02E+03 | 2.92E+03 | 5.00E+02 | 3.60E+03 | 1.56E+03 | 1.56E+03 |
| 1.71E+02 | 1.50E+03 | 9.88E+02 | 2.92E+03 | 5.01E+02 | 3.66E+03 | 1.56E+03 | 1.49E+03 |
| 1.72E+02 | 1.52E+03 | 9.60E+02 | 2.92E+03 | 5.02E+02 | 3.73E+03 | 1.56E+03 | 1.42E+03 |
| 1.73E+02 | 1.53E+03 | 9.32E+02 | 2.92E+03 | 5.03E+02 | 3.80E+03 | 1.56E+03 | 1.35E+03 |
| 1.74E+02 | 1.54E+03 | 9.04E+02 | 2.92E+03 | 5.04E+02 | 3.86E+03 | 1.56E+03 | 1.29E+03 |
| 1.75E+02 | 1.56E+03 | 8.80E+02 | 2.92E+03 | 5.05E+02 | 3.93E+03 | 1.56E+03 | 1.22E+03 |
| 1.76E+02 | 1.58E+03 | 8.80E+02 | 2.92E+03 | 5.06E+02 | 4.00E+03 | 1.56E+03 | 1.15E+03 |
| 1.77E+02 | 1.61E+03 | 8.80E+02 | 2.92E+03 | 5.07E+02 | 4.07E+03 | 1.56E+03 | 1.16E+03 |
| 1.78E+02 | 1.64E+03 | 8.80E+02 | 2.92E+03 | 5.08E+02 | 4.14E+03 | 1.56E+03 | 1.20E+03 |
| 1.79E+02 | 1.67E+03 | 8.80E+02 | 2.92E+03 | 5.09E+02 | 4.20E+03 | 1.56E+03 | 1.24E+03 |
| 1.80E+02 | 1.69E+03 | 8.80E+02 | 2.92E+03 | 5.10E+02 | 4.28E+03 | 1.56E+03 | 1.29E+03 |
| 1.81E+02 | 1.72E+03 | 8.80E+02 | 2.92E+03 | 5.11E+02 | 1.56E+03 | 8.80E+02 | 1.33E+03 |
| 1.82E+02 | 1.75E+03 | 8.80E+02 | 2.92E+03 | 5.12E+02 | 1.56E+03 | 8.80E+02 | 1.37E+03 |
| 1.83E+02 | 1.78E+03 | 8.80E+02 | 2.92E+03 | 5.13E+02 | 1.56E+03 | 8.80E+02 | 1.41E+03 |
| 1.84E+02 | 1.80E+03 | 8.80E+02 | 2.92E+03 | 5.14E+02 | 1.56E+03 | 8.80E+02 | 1.45E+03 |
| 1.85E+02 | 1.83E+03 | 8.80E+02 | 2.92E+03 | 5.15E+02 | 1.56E+03 | 8.80E+02 | 1.49E+03 |
| 1.86E+02 | 1.86E+03 | 8.80E+02 | 2.92E+03 | 5.16E+02 | 1.56E+03 | 8.80E+02 | 1.53E+03 |
| 1.87E+02 | 1.88E+03 | 8.80E+02 | 2.92E+03 | 5.17E+02 | 1.56E+03 | 8.80E+02 | 1.57E+03 |
| 1.88E+02 | 1.91E+03 | 8.80E+02 | 2.92E+03 | 5.18E+02 | 1.56E+03 | 8.80E+02 | 1.61E+03 |
| 1.89E+02 | 1.94E+03 | 8.80E+02 | 2.92E+03 | 5.19E+02 | 1.56E+03 | 8.80E+02 | 1.65E+03 |
| 1.90E+02 | 1.96E+03 | 8.80E+02 | 2.92E+03 | 5.20E+02 | 1.56E+03 | 8.80E+02 | 1.69E+03 |
| 1.91E+02 | 1.99E+03 | 8.80E+02 | 2.92E+03 | 5.21E+02 | 1.56E+03 | 8.80E+02 | 1.74E+03 |
| 1.92E+02 | 2.02E+03 | 8.80E+02 | 2.92E+03 | 5.22E+02 | 1.56E+03 | 8.80E+02 | 1.78E+03 |
| 1.93E+02 | 2.05E+03 | 8.80E+02 | 2.92E+03 | 5.23E+02 | 1.56E+03 | 8.80E+02 | 1.82E+03 |
| 1.94E+02 | 2.07E+03 | 8.80E+02 | 2.92E+03 | 5.24E+02 | 1.56E+03 | 8.80E+02 | 1.86E+03 |
| 1.95E+02 | 2.10E+03 | 8.80E+02 | 2.92E+03 | 5.25E+02 | 1.56E+03 | 8.80E+02 | 1.90E+03 |
| 1.96E+02 | 2.13E+03 | 8.80E+02 | 2.92E+03 | 5.26E+02 | 1.56E+03 | 8.80E+02 | 1.94E+03 |
| 1.97E+02 | 2.16E+03 | 8.80E+02 | 2.92E+03 | 5.27E+02 | 1.56E+03 | 8.80E+02 | 1.98E+03 |
| 1.98E+02 | 2.18E+03 | 8.80E+02 | 2.92E+03 | 5.28E+02 | 1.56E+03 | 8.80E+02 | 2.02E+03 |
| 1.99E+02 | 2.21E+03 | 8.80E+02 | 2.92E+03 | 5.29E+02 | 1.56E+03 | 8.80E+02 | 2.06E+03 |
| 2.00E+02 | 2.24E+03 | 8.80E+02 | 2.92E+03 | 5.30E+02 | 1.56E+03 | 8.80E+02 | 2.10E+03 |
| 2.01E+02 | 2.29E+03 | 9.32E+02 | 2.92E+03 | 5.31E+02 | 1.56E+03 | 8.80E+02 | 2.14E+03 |
| 2.02E+02 | 2.34E+03 | 9.88E+02 | 2.92E+03 | 5.32E+02 | 1.56E+03 | 8.80E+02 | 2.18E+03 |
| 2.03E+02 | 2.40E+03 | 1.04E+03 | 2.92E+03 | 5.33E+02 | 1.56E+03 | 8.80E+02 | 2.22E+03 |
| 2.04E+02 | 2.45E+03 | 1.10E+03 | 2.92E+03 | 5.34E+02 | 1.54E+03 | 8.92E+02 | 2.25E+03 |
| 2.05E+02 | 2.51E+03 | 1.15E+03 | 2.92E+03 | 5.35E+02 | 1.51E+03 | 9.12E+02 | 2.27E+03 |
| 2.06E+02 | 2.56E+03 | 1.20E+03 | 2.92E+03 | 5.36E+02 | 1.48E+03 | 9.32E+02 | 2.29E+03 |
| 2.07E+02 | 2.62E+03 | 1.26E+03 | 2.92E+03 | 5.37E+02 | 1.44E+03 | 9.52E+02 | 2.31E+03 |
| 2.08E+02 | 2.67E+03 | 1.31E+03 | 2.92E+03 | 5.38E+02 | 1.42E+03 | 9.72E+02 | 2.33E+03 |

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|----------|----------|----------|----------|----------|----------|----------|----------|
| 2.09E+02 | 2.72E+03 | 1.37E+03 | 2.92E+03 | 5.39E+02 | 1.38E+03 | 9.96E+02 | 2.35E+03 |
| 2.10E+02 | 2.78E+03 | 1.42E+03 | 2.92E+03 | 5.40E+02 | 1.35E+03 | 1.02E+03 | 2.37E+03 |
| 2.11E+02 | 2.83E+03 | 1.48E+03 | 2.92E+03 | 5.41E+02 | 1.32E+03 | 1.04E+03 | 2.39E+03 |
| 2.12E+02 | 2.89E+03 | 1.53E+03 | 2.92E+03 | 5.42E+02 | 1.29E+03 | 1.06E+03 | 2.41E+03 |
| 2.13E+02 | 2.94E+03 | 1.58E+03 | 2.92E+03 | 5.43E+02 | 1.26E+03 | 1.08E+03 | 2.43E+03 |
| 2.14E+02 | 3.00E+03 | 1.64E+03 | 2.92E+03 | 5.44E+02 | 1.23E+03 | 1.10E+03 | 2.45E+03 |
| 2.15E+02 | 3.05E+03 | 1.69E+03 | 2.92E+03 | 5.45E+02 | 1.20E+03 | 1.12E+03 | 2.48E+03 |
| 2.16E+02 | 3.10E+03 | 1.75E+03 | 2.92E+03 | 5.46E+02 | 1.17E+03 | 1.14E+03 | 2.50E+03 |
| 2.17E+02 | 3.16E+03 | 1.80E+03 | 2.92E+03 | 5.47E+02 | 1.14E+03 | 1.16E+03 | 2.52E+03 |
| 2.18E+02 | 3.21E+03 | 1.86E+03 | 2.92E+03 | 5.48E+02 | 1.11E+03 | 1.18E+03 | 2.54E+03 |
| 2.19E+02 | 3.27E+03 | 1.91E+03 | 2.92E+03 | 5.49E+02 | 1.08E+03 | 1.20E+03 | 2.56E+03 |
| 2.20E+02 | 3.32E+03 | 1.96E+03 | 2.92E+03 | 5.50E+02 | 1.05E+03 | 1.22E+03 | 2.58E+03 |
| 2.21E+02 | 3.38E+03 | 2.02E+03 | 2.92E+03 | 5.51E+02 | 1.02E+03 | 1.24E+03 | 2.60E+03 |
| 2.22E+02 | 3.43E+03 | 2.07E+03 | 2.92E+03 | 5.52E+02 | 9.88E+02 | 1.26E+03 | 2.62E+03 |
| 2.23E+02 | 3.48E+03 | 2.13E+03 | 2.92E+03 | 5.53E+02 | 9.56E+02 | 1.28E+03 | 2.64E+03 |
| 2.24E+02 | 3.54E+03 | 2.18E+03 | 2.92E+03 | 5.54E+02 | 9.28E+02 | 1.30E+03 | 2.66E+03 |
| 2.25E+02 | 2.00E+02 | 2.00E+02 | 2.00E+02 | 5.55E+02 | 8.96E+02 | 1.32E+03 | 2.68E+03 |
| 2.26E+02 | 2.00E+02 | 2.00E+02 | 2.00E+02 | 5.56E+02 | 8.64E+02 | 1.34E+03 | 2.70E+03 |
| 2.27E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 | 5.57E+02 | 8.36E+02 | 1.36E+03 | 2.72E+03 |
| 2.28E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 | 5.58E+02 | 8.04E+02 | 1.38E+03 | 2.74E+03 |
| 2.29E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 | 5.59E+02 | 7.72E+02 | 1.40E+03 | 2.76E+03 |
| 2.30E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 | 5.60E+02 | 7.44E+02 | 1.42E+03 | 2.78E+03 |
| 2.31E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 | 5.61E+02 | 7.12E+02 | 1.44E+03 | 2.80E+03 |
| 2.32E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 | 5.62E+02 | 6.80E+02 | 1.46E+03 | 2.82E+03 |
| 2.33E+02 | 4.96E+03 | 8.80E+02 | 2.92E+03 | 5.63E+02 | 6.52E+02 | 1.48E+03 | 2.84E+03 |
| 2.34E+02 | 4.96E+03 | 8.80E+02 | 2.97E+03 | 5.64E+02 | 6.20E+02 | 1.50E+03 | 2.86E+03 |
| 2.35E+02 | 4.96E+03 | 8.80E+02 | 3.05E+03 | 5.65E+02 | 5.90E+02 | 1.52E+03 | 2.88E+03 |
| 2.36E+02 | 4.96E+03 | 8.80E+02 | 3.13E+03 | 5.66E+02 | 5.60E+02 | 1.54E+03 | 2.90E+03 |
| 2.37E+02 | 4.96E+03 | 8.80E+02 | 3.21E+03 | 5.67E+02 | 5.50E+02 | 1.56E+03 | 2.92E+03 |
| 2.38E+02 | 4.96E+03 | 8.80E+02 | 3.30E+03 | 5.68E+02 | 5.80E+02 | 1.56E+03 | 2.92E+03 |
| 2.39E+02 | 4.96E+03 | 8.80E+02 | 3.38E+03 | 5.69E+02 | 6.12E+02 | 1.56E+03 | 2.92E+03 |
| 2.40E+02 | 4.96E+03 | 8.80E+02 | 3.46E+03 | 5.70E+02 | 6.40E+02 | 1.56E+03 | 2.92E+03 |
| 2.41E+02 | 4.96E+03 | 8.80E+02 | 3.54E+03 | 5.71E+02 | 6.72E+02 | 1.56E+03 | 2.92E+03 |
| 2.42E+02 | 5.00E+03 | 8.80E+02 | 3.62E+03 | 5.72E+02 | 7.04E+02 | 1.56E+03 | 2.92E+03 |
| 2.43E+02 | 5.16E+03 | 8.80E+02 | 3.70E+03 | 5.73E+02 | 7.32E+02 | 1.56E+03 | 2.92E+03 |
| 2.44E+02 | 5.32E+03 | 8.80E+02 | 3.78E+03 | 5.74E+02 | 7.64E+02 | 1.56E+03 | 2.92E+03 |
| 2.45E+02 | 5.48E+03 | 8.80E+02 | 3.86E+03 | 5.75E+02 | 7.92E+02 | 1.56E+03 | 2.92E+03 |
| 2.46E+02 | 5.64E+03 | 8.80E+02 | 3.95E+03 | 5.76E+02 | 8.24E+02 | 1.56E+03 | 2.92E+03 |
| 2.47E+02 | 5.84E+03 | 8.80E+02 | 4.03E+03 | 5.77E+02 | 8.56E+02 | 1.56E+03 | 2.92E+03 |
| 2.48E+02 | 6.00E+03 | 8.80E+02 | 4.11E+03 | 5.78E+02 | 8.84E+02 | 1.56E+03 | 2.92E+03 |
| 2.49E+02 | 6.16E+03 | 8.80E+02 | 4.19E+03 | 5.79E+02 | 9.16E+02 | 1.56E+03 | 2.92E+03 |
| 2.50E+02 | 6.32E+03 | 8.80E+02 | 4.28E+03 | 5.80E+02 | 9.48E+02 | 1.56E+03 | 2.92E+03 |
| 2.51E+02 | 6.64E+03 | 9.20E+02 | 4.44E+03 | 5.81E+02 | 9.76E+02 | 1.56E+03 | 2.92E+03 |
| 2.52E+02 | 6.96E+03 | 9.60E+02 | 4.60E+03 | 5.82E+02 | 1.01E+03 | 1.56E+03 | 2.92E+03 |
| 2.53E+02 | 7.28E+03 | 1.00E+03 | 4.76E+03 | 5.83E+02 | 1.04E+03 | 1.56E+03 | 2.92E+03 |
| 2.54E+02 | 7.60E+03 | 1.04E+03 | 4.92E+03 | 5.84E+02 | 1.07E+03 | 1.56E+03 | 2.92E+03 |
| 2.55E+02 | 7.92E+03 | 1.08E+03 | 5.08E+03 | 5.85E+02 | 1.10E+03 | 1.56E+03 | 2.92E+03 |
| 2.56E+02 | 8.28E+03 | 1.12E+03 | 5.24E+03 | 5.86E+02 | 1.13E+03 | 1.56E+03 | 2.92E+03 |
| 2.57E+02 | 8.60E+03 | 1.16E+03 | 5.40E+03 | 5.87E+02 | 1.16E+03 | 1.56E+03 | 2.92E+03 |
| 2.58E+02 | 8.92E+03 | 1.20E+03 | 5.56E+03 | 5.88E+02 | 1.19E+03 | 1.56E+03 | 2.92E+03 |

| | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 2.59E+02 | 9.04E+03 | 1.24E+03 | 5.68E+03 | 5.89E+02 | 1.22E+03 | 1.56E+03 | 2.92E+03 |
| 2.60E+02 | 9.04E+03 | 1.29E+03 | 5.76E+03 | 5.90E+02 | 1.25E+03 | 1.56E+03 | 2.92E+03 |
| 2.61E+02 | 9.04E+03 | 1.33E+03 | 5.84E+03 | 5.91E+02 | 1.28E+03 | 1.56E+03 | 2.92E+03 |
| 2.62E+02 | 9.04E+03 | 1.37E+03 | 5.92E+03 | 5.92E+02 | 1.31E+03 | 1.56E+03 | 2.92E+03 |
| 2.63E+02 | 9.04E+03 | 1.41E+03 | 6.00E+03 | 5.93E+02 | 1.34E+03 | 1.56E+03 | 2.92E+03 |
| 2.64E+02 | 9.04E+03 | 1.45E+03 | 6.08E+03 | 5.94E+02 | 1.38E+03 | 1.56E+03 | 2.92E+03 |
| 2.65E+02 | 9.04E+03 | 1.49E+03 | 6.16E+03 | 5.95E+02 | 1.40E+03 | 1.56E+03 | 2.92E+03 |
| 2.66E+02 | 9.04E+03 | 1.53E+03 | 6.24E+03 | 5.96E+02 | 1.44E+03 | 1.56E+03 | 2.92E+03 |
| 2.67E+02 | 8.96E+03 | 1.56E+03 | 6.36E+03 | 5.97E+02 | 1.47E+03 | 1.56E+03 | 2.92E+03 |
| 2.68E+02 | 8.80E+03 | 1.56E+03 | 6.52E+03 | 5.98E+02 | 1.50E+03 | 1.56E+03 | 2.92E+03 |
| 2.69E+02 | 8.64E+03 | 1.56E+03 | 6.68E+03 | 5.99E+02 | 1.53E+03 | 1.56E+03 | 2.92E+03 |
| 2.70E+02 | 8.48E+03 | 1.56E+03 | 6.84E+03 | 6.00E+02 | 1.56E+03 | 1.56E+03 | 2.92E+03 |
| 2.71E+02 | 8.32E+03 | 1.56E+03 | 7.00E+03 | 6.01E+02 | 1.62E+03 | 1.54E+03 | 2.96E+03 |
| 2.72E+02 | 8.16E+03 | 1.56E+03 | 7.16E+03 | 6.02E+02 | 1.68E+03 | 1.52E+03 | 3.00E+03 |
| 2.73E+02 | 8.00E+03 | 1.56E+03 | 7.36E+03 | 6.03E+02 | 1.74E+03 | 1.50E+03 | 3.04E+03 |
| 2.74E+02 | 7.84E+03 | 1.56E+03 | 7.52E+03 | 6.04E+02 | 1.80E+03 | 1.48E+03 | 3.08E+03 |
| 2.75E+02 | 7.68E+03 | 1.56E+03 | 7.68E+03 | 6.05E+02 | 1.86E+03 | 1.46E+03 | 3.12E+03 |
| 2.76E+02 | 7.60E+03 | 1.60E+03 | 7.84E+03 | 6.06E+02 | 1.92E+03 | 1.44E+03 | 3.16E+03 |
| 2.77E+02 | 7.52E+03 | 1.64E+03 | 8.00E+03 | 6.07E+02 | 1.98E+03 | 1.42E+03 | 3.20E+03 |
| 2.78E+02 | 7.44E+03 | 1.68E+03 | 8.16E+03 | 6.08E+02 | 2.05E+03 | 1.40E+03 | 3.24E+03 |
| 2.79E+02 | 7.36E+03 | 1.72E+03 | 8.32E+03 | 6.09E+02 | 2.11E+03 | 1.38E+03 | 3.28E+03 |
| 2.80E+02 | 7.24E+03 | 1.76E+03 | 8.48E+03 | 6.10E+02 | 2.17E+03 | 1.35E+03 | 3.32E+03 |
| 2.81E+02 | 7.16E+03 | 1.80E+03 | 8.64E+03 | 6.11E+02 | 2.23E+03 | 1.33E+03 | 3.36E+03 |
| 2.82E+02 | 7.08E+03 | 1.84E+03 | 8.80E+03 | 6.12E+02 | 2.29E+03 | 1.31E+03 | 3.40E+03 |
| 2.83E+02 | 7.00E+03 | 1.88E+03 | 8.96E+03 | 6.13E+02 | 2.35E+03 | 1.29E+03 | 3.44E+03 |
| 2.84E+02 | 6.88E+03 | 1.90E+03 | 9.12E+03 | 6.14E+02 | 2.41E+03 | 1.27E+03 | 3.48E+03 |
| 2.85E+02 | 6.72E+03 | 1.90E+03 | 9.28E+03 | 6.15E+02 | 2.48E+03 | 1.25E+03 | 3.53E+03 |
| 2.86E+02 | 6.56E+03 | 1.90E+03 | 9.44E+03 | 6.16E+02 | 2.54E+03 | 1.23E+03 | 3.57E+03 |
| 2.87E+02 | 6.40E+03 | 1.90E+03 | 9.64E+03 | 6.17E+02 | 2.60E+03 | 1.21E+03 | 3.61E+03 |
| 2.88E+02 | 6.24E+03 | 1.90E+03 | 9.80E+03 | 6.18E+02 | 2.66E+03 | 1.19E+03 | 3.65E+03 |
| 2.89E+02 | 6.08E+03 | 1.90E+03 | 9.96E+03 | 6.19E+02 | 2.72E+03 | 1.17E+03 | 3.69E+03 |
| 2.90E+02 | 5.92E+03 | 1.90E+03 | 1.01E+04 | 6.20E+02 | 2.78E+03 | 1.15E+03 | 3.73E+03 |
| 2.91E+02 | 5.72E+03 | 1.90E+03 | 1.03E+04 | 6.21E+02 | 2.84E+03 | 1.13E+03 | 3.77E+03 |
| 2.92E+02 | 5.56E+03 | 1.91E+03 | 1.04E+04 | 6.22E+02 | 2.90E+03 | 1.11E+03 | 3.81E+03 |
| 2.93E+02 | 5.40E+03 | 1.95E+03 | 1.06E+04 | 6.23E+02 | 2.96E+03 | 1.09E+03 | 3.85E+03 |
| 2.94E+02 | 5.24E+03 | 1.99E+03 | 1.08E+04 | 6.24E+02 | 3.02E+03 | 1.07E+03 | 3.89E+03 |
| 2.95E+02 | 5.08E+03 | 2.03E+03 | 1.09E+04 | 6.25E+02 | 3.08E+03 | 1.05E+03 | 3.93E+03 |
| 2.96E+02 | 4.92E+03 | 2.07E+03 | 1.11E+04 | 6.26E+02 | 3.15E+03 | 1.03E+03 | 3.98E+03 |
| 2.97E+02 | 4.76E+03 | 2.12E+03 | 1.12E+04 | 6.27E+02 | 3.21E+03 | 1.01E+03 | 4.02E+03 |
| 2.98E+02 | 4.60E+03 | 2.16E+03 | 1.14E+04 | 6.28E+02 | 3.27E+03 | 9.88E+02 | 4.06E+03 |
| 2.99E+02 | 4.44E+03 | 2.20E+03 | 1.16E+04 | 6.29E+02 | 3.33E+03 | 9.68E+02 | 4.10E+03 |
| 3.00E+02 | 4.28E+03 | 2.24E+03 | 1.17E+04 | 6.30E+02 | 3.39E+03 | 9.48E+02 | 4.14E+03 |
| 3.01E+02 | 4.32E+03 | 2.24E+03 | 1.20E+04 | 6.31E+02 | 3.45E+03 | 9.28E+02 | 4.18E+03 |
| 3.02E+02 | 4.36E+03 | 2.24E+03 | 1.22E+04 | 6.32E+02 | 3.51E+03 | 9.04E+02 | 4.20E+03 |
| 3.03E+02 | 4.40E+03 | 2.24E+03 | 1.25E+04 | 6.33E+02 | 3.57E+03 | 8.84E+02 | 4.24E+03 |
| 3.04E+02 | 4.44E+03 | 2.24E+03 | 1.27E+04 | 6.34E+02 | 3.61E+03 | 8.72E+02 | 4.24E+03 |
| 3.05E+02 | 4.48E+03 | 2.24E+03 | 1.30E+04 | 6.35E+02 | 3.63E+03 | 8.60E+02 | 4.20E+03 |
| 3.06E+02 | 4.52E+03 | 2.24E+03 | 1.32E+04 | 6.36E+02 | 3.65E+03 | 8.52E+02 | 4.16E+03 |
| 3.07E+02 | 4.56E+03 | 2.24E+03 | 1.34E+04 | 6.37E+02 | 3.67E+03 | 8.40E+02 | 4.12E+03 |
| 3.08E+02 | 4.60E+03 | 2.24E+03 | 1.37E+04 | 6.38E+02 | 3.69E+03 | 8.32E+02 | 4.08E+03 |

| | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 3.09E+02 | 4.64E+03 | 2.34E+03 | 1.39E+04 | 6.39E+02 | 3.71E+03 | 8.20E+02 | 4.04E+03 |
| 3.10E+02 | 4.68E+03 | 2.51E+03 | 1.42E+04 | 6.40E+02 | 3.73E+03 | 8.12E+02 | 4.00E+03 |
| 3.11E+02 | 4.72E+03 | 2.67E+03 | 1.44E+04 | 6.41E+02 | 3.75E+03 | 8.00E+02 | 3.96E+03 |
| 3.12E+02 | 4.76E+03 | 2.83E+03 | 1.47E+04 | 6.42E+02 | 3.77E+03 | 7.92E+02 | 3.92E+03 |
| 3.13E+02 | 4.80E+03 | 3.00E+03 | 1.49E+04 | 6.43E+02 | 3.79E+03 | 7.80E+02 | 3.88E+03 |
| 3.14E+02 | 4.84E+03 | 3.16E+03 | 1.52E+04 | 6.44E+02 | 3.81E+03 | 7.72E+02 | 3.84E+03 |
| 3.15E+02 | 4.88E+03 | 3.32E+03 | 1.54E+04 | 6.45E+02 | 3.83E+03 | 7.60E+02 | 3.80E+03 |
| 3.16E+02 | 4.92E+03 | 3.48E+03 | 1.56E+04 | 6.46E+02 | 3.85E+03 | 7.48E+02 | 3.76E+03 |
| 3.17E+02 | 4.96E+03 | 3.62E+03 | 1.59E+04 | 6.47E+02 | 3.87E+03 | 7.40E+02 | 3.72E+03 |
| 3.18E+02 | 5.00E+03 | 3.70E+03 | 1.60E+04 | 6.48E+02 | 3.89E+03 | 7.28E+02 | 3.68E+03 |
| 3.19E+02 | 5.04E+03 | 3.78E+03 | 1.62E+04 | 6.49E+02 | 3.91E+03 | 7.20E+02 | 3.64E+03 |
| 3.20E+02 | 5.08E+03 | 3.86E+03 | 1.64E+04 | 6.50E+02 | 3.93E+03 | 7.08E+02 | 3.60E+03 |
| 3.21E+02 | 5.12E+03 | 3.95E+03 | 1.65E+04 | 6.51E+02 | 3.95E+03 | 7.00E+02 | 3.55E+03 |
| 3.22E+02 | 5.16E+03 | 4.03E+03 | 1.67E+04 | 6.52E+02 | 3.98E+03 | 6.88E+02 | 3.51E+03 |
| 3.23E+02 | 5.20E+03 | 4.11E+03 | 1.68E+04 | 6.53E+02 | 4.00E+03 | 6.80E+02 | 3.47E+03 |
| 3.24E+02 | 5.24E+03 | 4.19E+03 | 1.70E+04 | 6.54E+02 | 4.02E+03 | 6.68E+02 | 3.43E+03 |
| 3.25E+02 | 5.28E+03 | 4.28E+03 | 1.72E+04 | 6.55E+02 | 4.04E+03 | 6.60E+02 | 3.39E+03 |
| 3.26E+02 | 5.32E+03 | 4.36E+03 | 1.76E+04 | 6.56E+02 | 4.06E+03 | 6.48E+02 | 3.35E+03 |
| 3.27E+02 | 5.36E+03 | 4.44E+03 | 1.80E+04 | 6.57E+02 | 4.08E+03 | 6.36E+02 | 3.31E+03 |
| 3.28E+02 | 5.40E+03 | 4.52E+03 | 1.84E+04 | 6.58E+02 | 4.10E+03 | 6.28E+02 | 3.27E+03 |
| 3.29E+02 | 5.44E+03 | 4.60E+03 | 1.88E+04 | 6.59E+02 | 4.12E+03 | 6.16E+02 | 3.23E+03 |
| 3.30E+02 | 5.48E+03 | 4.68E+03 | 1.92E+04 | 6.60E+02 | 4.14E+03 | 6.08E+02 | 3.19E+03 |
| 3.31E+02 | 5.52E+03 | 4.76E+03 | 1.96E+04 | 6.61E+02 | 4.16E+03 | 5.97E+02 | 3.15E+03 |
| 3.32E+02 | 5.56E+03 | 4.84E+03 | 2.00E+04 | 6.62E+02 | 4.18E+03 | 5.87E+02 | 3.10E+03 |
| 3.33E+02 | 5.60E+03 | 4.92E+03 | 2.04E+04 | 6.63E+02 | 4.20E+03 | 5.77E+02 | 3.06E+03 |
| 3.34E+02 | 5.60E+03 | 5.08E+03 | 2.08E+04 | 6.64E+02 | 4.20E+03 | 5.66E+02 | 3.02E+03 |
| 3.35E+02 | 5.56E+03 | 5.24E+03 | 2.12E+04 | 6.65E+02 | 4.24E+03 | 5.56E+02 | 2.98E+03 |
| 3.36E+02 | 5.52E+03 | 5.40E+03 | 2.16E+04 | 6.66E+02 | 4.24E+03 | 5.46E+02 | 2.94E+03 |
| 3.37E+02 | 5.48E+03 | 5.56E+03 | 2.20E+04 | 6.67E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.38E+02 | 5.44E+03 | 5.72E+03 | 2.25E+04 | 6.68E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.39E+02 | 5.40E+03 | 5.88E+03 | 2.29E+04 | 6.69E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.40E+02 | 5.36E+03 | 6.04E+03 | 2.33E+04 | 6.70E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.41E+02 | 5.32E+03 | 6.20E+03 | 2.37E+04 | 6.71E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.42E+02 | 5.28E+03 | 6.32E+03 | 2.40E+04 | 6.72E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.43E+02 | 5.24E+03 | 6.40E+03 | 2.41E+04 | 6.73E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.44E+02 | 5.20E+03 | 6.48E+03 | 2.42E+04 | 6.74E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.45E+02 | 5.16E+03 | 6.60E+03 | 2.42E+04 | 6.75E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.46E+02 | 5.32E+03 | 6.68E+03 | 2.43E+04 | 6.76E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.47E+02 | 5.56E+03 | 6.76E+03 | 2.44E+04 | 6.77E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.48E+02 | 5.84E+03 | 6.84E+03 | 2.45E+04 | 6.78E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.49E+02 | 6.08E+03 | 6.92E+03 | 2.46E+04 | 6.79E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |
| 3.50E+02 | 6.32E+03 | 7.00E+03 | 2.46E+04 | 6.80E+02 | 4.28E+03 | 5.40E+02 | 2.92E+03 |

No se han introducido los informes de los bloques 5 y 7 por su gran longitud. Pero si los gráficos de cada bloque:

Bloque 5:

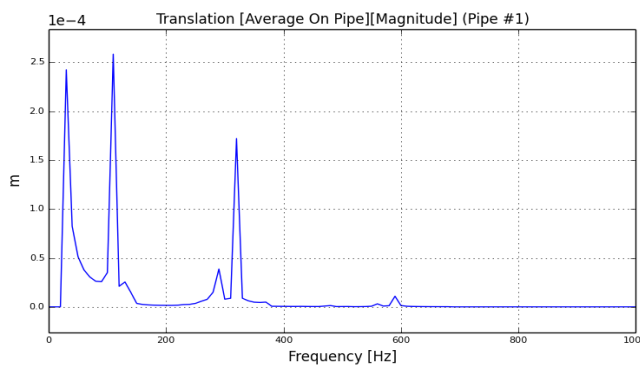


Figura 102. Traslado (promedio en el tubo)

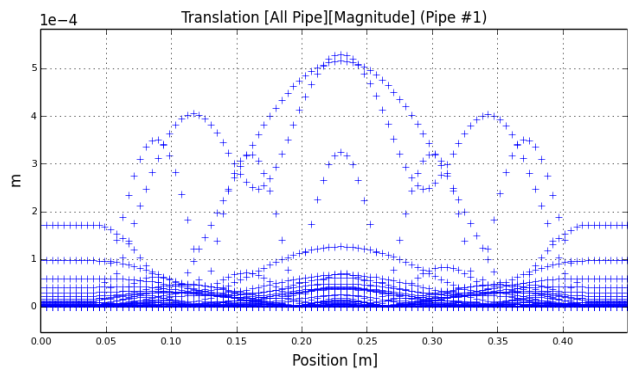


Figura 103. Traslado (todo el tubo)

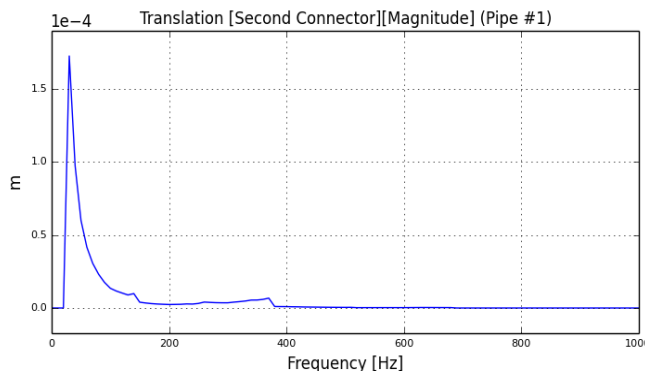


Figura 104. Traslado

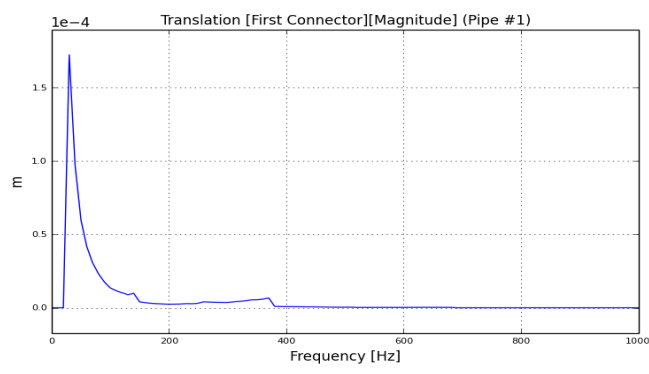


Figura 105. Traslado

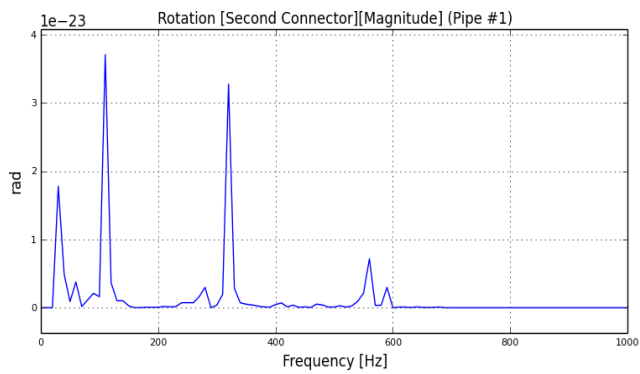


Figura 106. Rotación

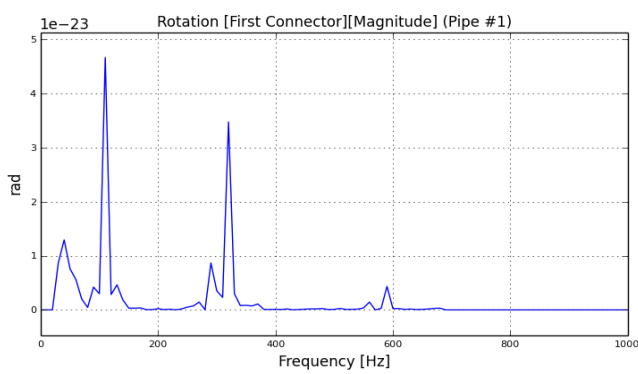


Figura 107. Rotación

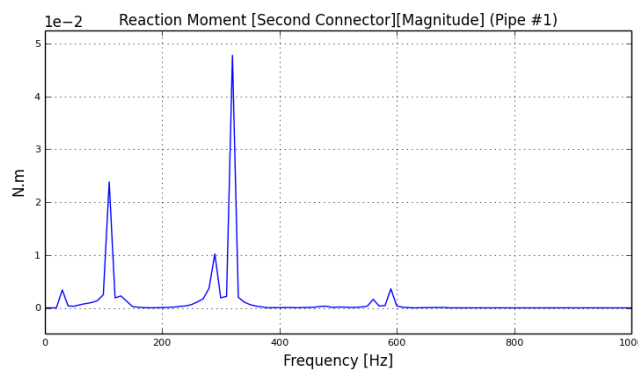


Figura 108. Momento de reacción

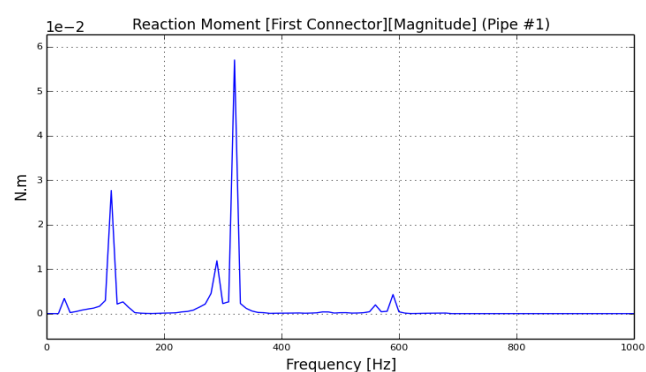


Figura 109. Momento de reacción

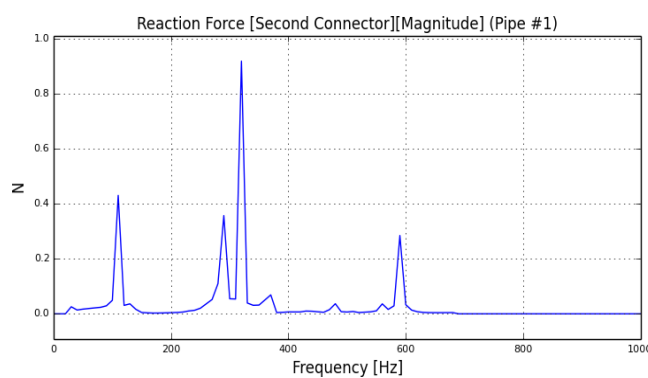


Figura 110. Fuerza de reacción

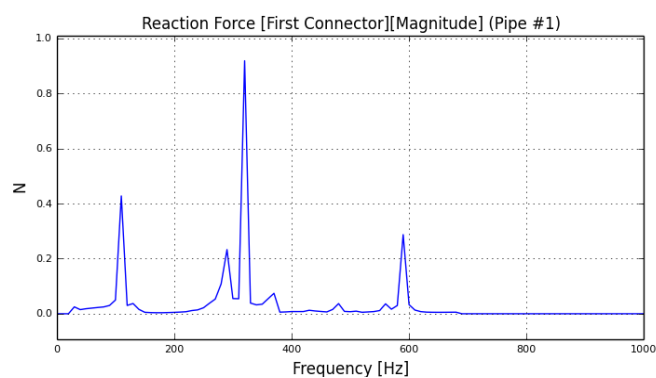


Figura 111. Fuerza de reacción

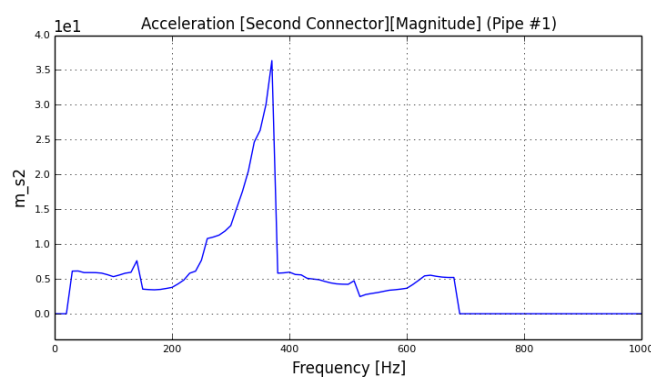


Figura 112. Aceleración

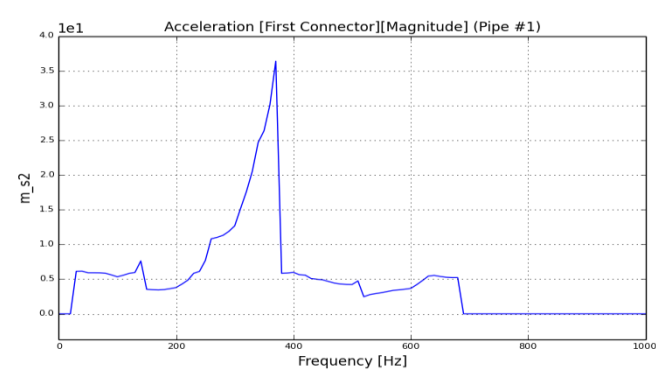


Figura 113. Aceleración

Bloque 7:

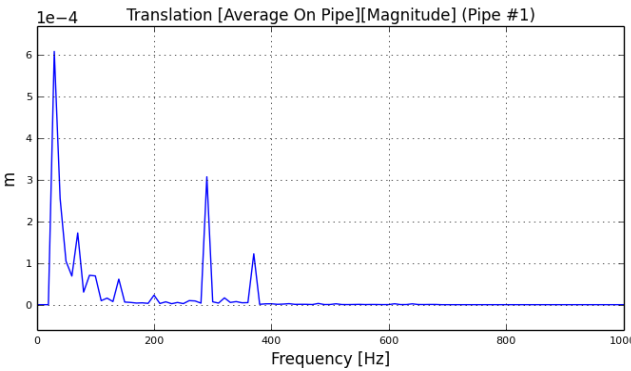


Figura 114. Traslado (promedio en el tubo)

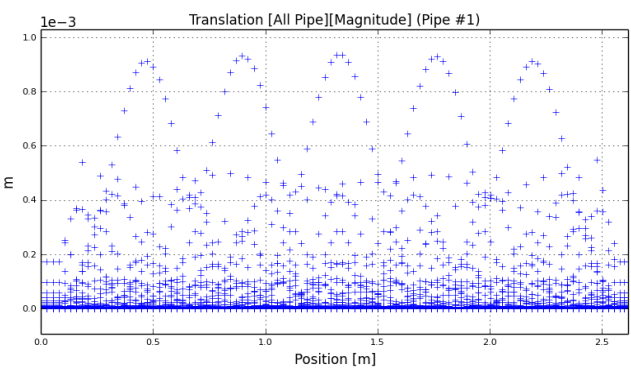


Figura 115. Traslado (todo el tubo)

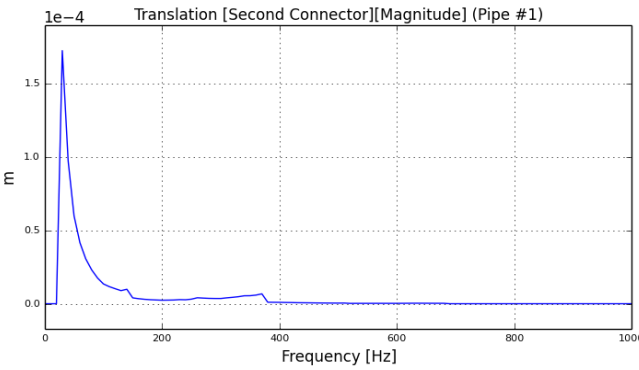


Figura 116. Traslado

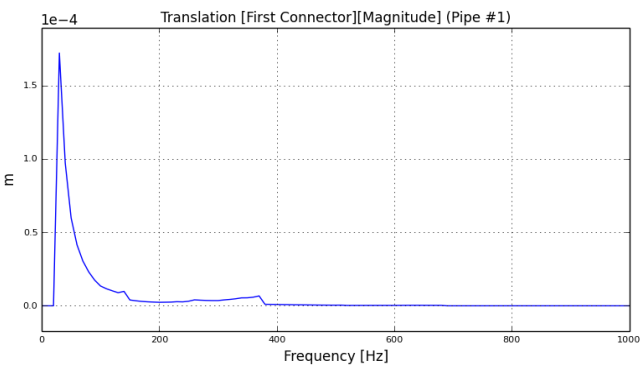


Figura 117. Traslado

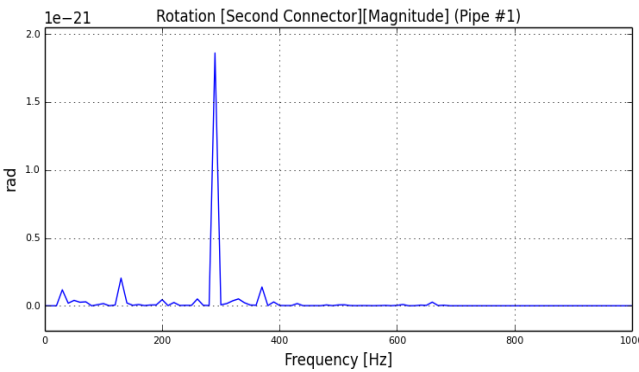


Figura 118. Rotación

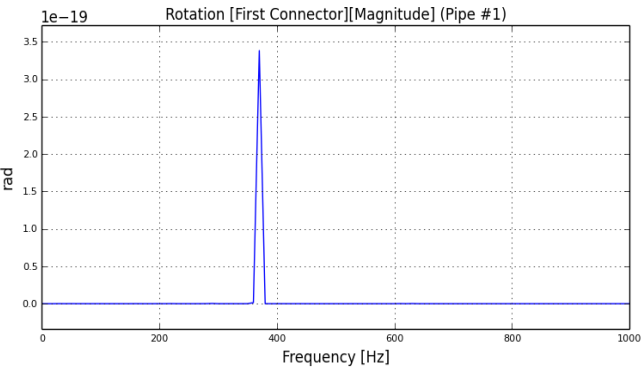


Figura 119. Rotación

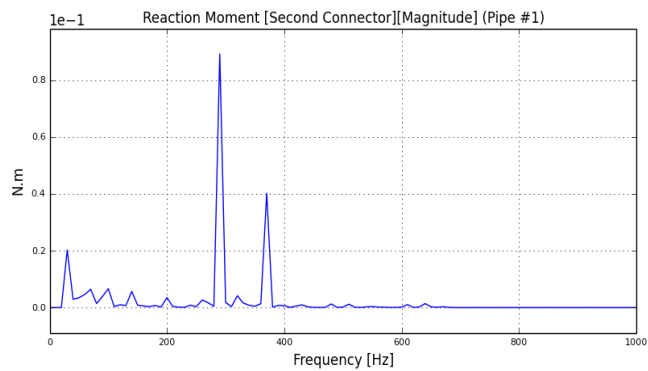


Figura 120. Momento de reacción

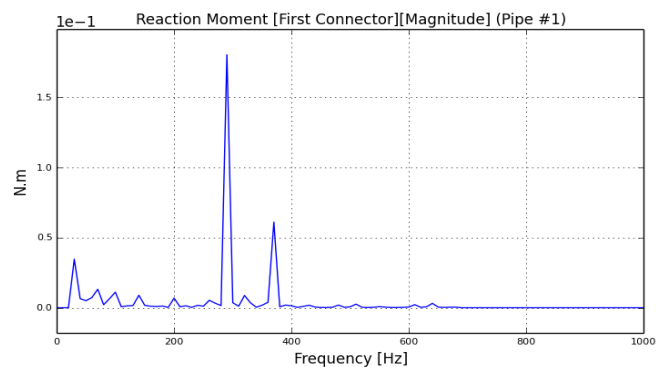


Figura 121. Momento de reacción

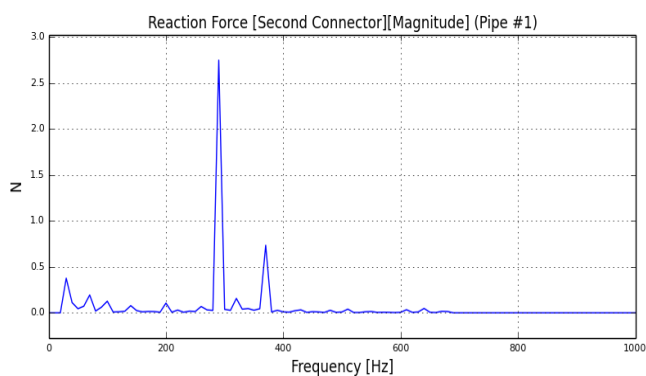


Figura 122. Fuerza de reacción

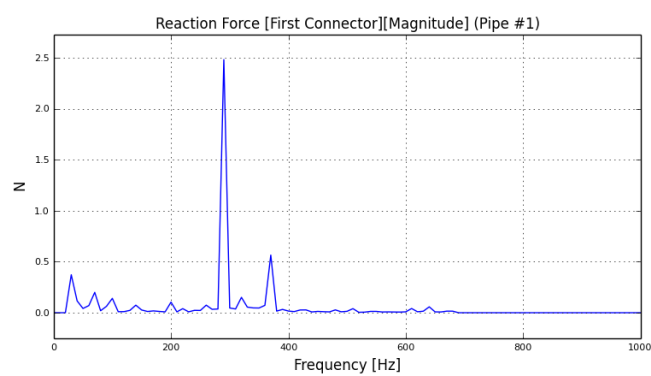


Figura 123. Fuerza de reacción

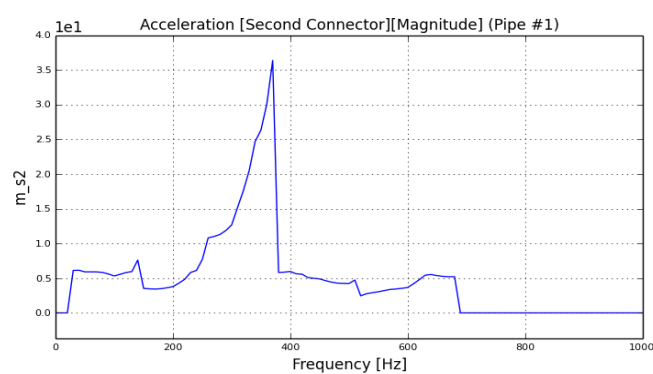


Figura 124. Aceleración

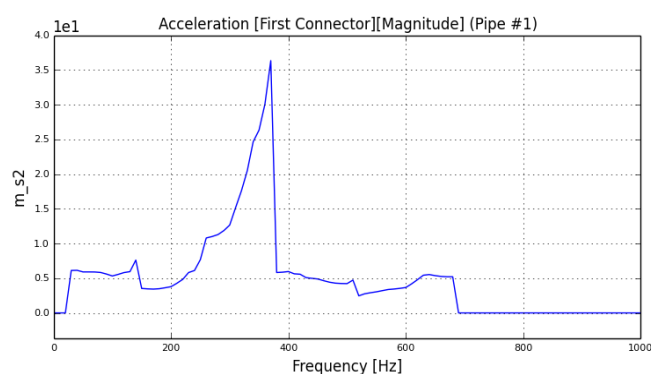


Figura 125. Aceleración

5. Análisis de la respuesta dinámica

Los datos del desplazamiento del archivo de texto es el siguiente:

(No tiene desplazamiento en Y ni en Z, pero se han de indicar)

Tabla 5. Desplazamiento en el eje X

| Time(s) | Disp_X(mm) | Disp_Y(mm) | Disp_Z(mm) | Time(s) | Disp_X(mm) | Disp_Y(mm) | Disp_Z(mm) |
|---------|--------------|------------|------------|---------|--------------|------------|------------|
| 0 | -0.001273723 | 0 | 0 | 2.505 | -3.745030673 | 0 | 0 |
| 0.005 | 1.256738862 | 0 | 0 | 2.51 | 0.111879623 | 0 | 0 |
| 0.01 | 2.50388623 | 0 | 0 | 2.515 | 3.954023439 | 0 | 0 |
| 0.015 | 3.719361982 | 0 | 0 | 2.52 | 7.188116912 | 0 | 0 |
| 0.02 | 4.882137042 | 0 | 0 | 2.525 | 9.312922951 | 0 | 0 |
| 0.025 | 5.971334022 | 0 | 0 | 2.53 | 9.997293157 | 0 | 0 |
| 0.03 | 6.966622184 | 0 | 0 | 2.535 | 9.132301638 | 0 | 0 |
| 0.035 | 7.848626253 | 0 | 0 | 2.54 | 6.849184633 | 0 | 0 |
| 0.04 | 8.599341439 | 0 | 0 | 2.545 | 3.500046771 | 0 | 0 |
| 0.045 | 9.202546256 | 0 | 0 | 2.55 | -0.395932589 | 0 | 0 |
| 0.05 | 9.644204098 | 0 | 0 | 2.555 | -4.232655862 | 0 | 0 |
| 0.055 | 9.912844001 | 0 | 0 | 2.56 | -7.411303323 | 0 | 0 |
| 0.06 | 9.999910776 | 0 | 0 | 2.565 | -9.433945234 | 0 | 0 |
| 0.065 | 9.900074555 | 0 | 0 | 2.57 | -9.981913466 | 0 | 0 |
| 0.07 | 9.611490001 | 0 | 0 | 2.575 | -8.966540857 | 0 | 0 |
| 0.075 | 9.135995792 | 0 | 0 | 2.58 | -6.544108872 | 0 | 0 |
| 0.08 | 8.479245705 | 0 | 0 | 2.585 | -3.092400356 | 0 | 0 |
| 0.085 | 7.650763585 | 0 | 0 | 2.59 | 0.847725878 | 0 | 0 |
| 0.09 | 6.6639157 | 0 | 0 | 2.595 | 4.65678215 | 0 | 0 |
| 0.095 | 5.535795549 | 0 | 0 | 2.6 | 7.733984267 | 0 | 0 |
| 0.1 | 4.287017925 | 0 | 0 | 2.605 | 9.592188106 | 0 | 0 |
| 0.105 | 2.941421083 | 0 | 0 | 2.61 | 9.935401542 | 0 | 0 |
| 0.11 | 1.525678076 | 0 | 0 | 2.615 | 8.706477966 | 0 | 0 |
| 0.115 | 0.068820699 | 0 | 0 | 2.62 | 6.097223386 | 0 | 0 |
| 0.12 | -1.398318014 | 0 | 0 | 2.625 | 2.519052288 | 0 | 0 |
| 0.125 | -2.843734246 | 0 | 0 | 2.63 | -1.461416957 | 0 | 0 |
| 0.13 | -4.234945815 | 0 | 0 | 2.635 | -5.21182069 | 0 | 0 |
| 0.135 | -5.539733065 | 0 | 0 | 2.64 | -8.134482408 | 0 | 0 |
| 0.14 | -6.726912527 | 0 | 0 | 2.645 | -9.761873916 | 0 | 0 |
| 0.145 | -7.767125595 | 0 | 0 | 2.65 | -9.831825229 | 0 | 0 |
| 0.15 | -8.633622766 | 0 | 0 | 2.655 | -8.330319001 | 0 | 0 |
| 0.155 | -9.303022735 | 0 | 0 | 2.66 | -5.494798249 | 0 | 0 |
| 0.16 | -9.756024802 | 0 | 0 | 2.665 | -1.777190241 | 0 | 0 |
| 0.165 | -9.978052841 | 0 | 0 | 2.67 | 2.227690553 | 0 | 0 |
| 0.17 | -9.959809407 | 0 | 0 | 2.675 | 5.877088381 | 0 | 0 |
| 0.175 | -9.697719583 | 0 | 0 | 2.68 | 8.583482447 | 0 | 0 |
| 0.18 | -9.19424586 | 0 | 0 | 2.685 | 9.909429438 | 0 | 0 |
| 0.185 | -8.458057696 | 0 | 0 | 2.69 | 9.638721899 | 0 | 0 |
| 0.19 | -7.504042464 | 0 | 0 | 2.695 | 7.812216128 | 0 | 0 |

| | | | | | | | |
|-------|--------------|---|---|-------|--------------|---|---|
| 0.195 | -6.35314815 | 0 | 0 | 2.7 | 4.722304284 | 0 | 0 |
| 0.2 | -5.032052419 | 0 | 0 | 2.705 | 0.866652782 | 0 | 0 |
| 0.205 | -3.572657405 | 0 | 0 | 2.71 | -3.13156459 | 0 | 0 |
| 0.21 | -2.011414702 | 0 | 0 | 2.715 | -6.624217831 | 0 | 0 |
| 0.215 | -0.388490367 | 0 | 0 | 2.72 | -9.043360365 | 0 | 0 |
| 0.22 | 1.253214745 | 0 | 0 | 2.725 | -9.993890214 | 0 | 0 |
| 0.225 | 2.869168651 | 0 | 0 | 2.73 | -9.318566371 | 0 | 0 |
| 0.23 | 4.41441007 | 0 | 0 | 2.735 | -7.124604446 | 0 | 0 |
| 0.235 | 5.844817902 | 0 | 0 | 2.74 | -3.767263932 | 0 | 0 |
| 0.24 | 7.118413761 | 0 | 0 | 2.745 | 0.207168051 | 0 | 0 |
| 0.245 | 8.196659719 | 0 | 0 | 2.75 | 4.149931178 | 0 | 0 |
| 0.25 | 9.045711178 | 0 | 0 | 2.755 | 7.415585405 | 0 | 0 |
| 0.255 | 9.637583647 | 0 | 0 | 2.76 | 9.467809895 | 0 | 0 |
| 0.26 | 9.951192419 | 0 | 0 | 2.765 | 9.967843284 | 0 | 0 |
| 0.265 | 9.973225636 | 0 | 0 | 2.77 | 8.830923637 | 0 | 0 |
| 0.27 | 9.698814237 | 0 | 0 | 2.775 | 6.241241898 | 0 | 0 |
| 0.275 | 9.131966686 | 0 | 0 | 2.78 | 2.622685262 | 0 | 0 |
| 0.28 | 8.285742163 | 0 | 0 | 2.785 | -1.430083122 | 0 | 0 |
| 0.285 | 7.182143037 | 0 | 0 | 2.79 | -5.249080208 | 0 | 0 |
| 0.29 | 5.851715661 | 0 | 0 | 2.795 | -8.203068657 | 0 | 0 |
| 0.295 | 4.332857764 | 0 | 0 | 2.8 | -9.802102261 | 0 | 0 |
| 0.3 | 2.670840564 | 0 | 0 | 2.805 | -9.779202793 | 0 | 0 |
| 0.305 | 0.916564009 | 0 | 0 | 2.81 | -8.135485167 | 0 | 0 |
| 0.31 | -0.874926119 | 0 | 0 | 2.815 | -5.141015942 | 0 | 0 |
| 0.315 | -2.646120596 | 0 | 0 | 2.82 | -1.290990908 | 0 | 0 |
| 0.32 | -4.338880668 | 0 | 0 | 2.825 | 2.775751668 | 0 | 0 |
| 0.325 | -5.896367485 | 0 | 0 | 2.83 | 6.382541492 | 0 | 0 |
| 0.33 | -7.265004359 | 0 | 0 | 2.835 | 8.927517925 | 0 | 0 |
| 0.335 | -8.396404466 | 0 | 0 | 2.84 | 9.984344491 | 0 | 0 |
| 0.34 | -9.249193992 | 0 | 0 | 2.845 | 9.374096679 | 0 | 0 |
| 0.345 | -9.790660649 | 0 | 0 | 2.85 | 7.196125255 | 0 | 0 |
| 0.35 | -9.998159902 | 0 | 0 | 2.855 | 3.812480875 | 0 | 0 |
| 0.355 | -9.860216506 | 0 | 0 | 2.86 | -0.211767147 | 0 | 0 |
| 0.36 | -9.377266785 | 0 | 0 | 2.865 | -4.20256625 | 0 | 0 |
| 0.365 | -8.561997587 | 0 | 0 | 2.87 | -7.489677949 | 0 | 0 |
| 0.37 | -7.439250641 | 0 | 0 | 2.875 | -9.519379645 | 0 | 0 |
| 0.375 | -6.045475865 | 0 | 0 | 2.88 | -9.948097489 | 0 | 0 |
| 0.38 | -4.427733575 | 0 | 0 | 2.885 | -8.701078424 | 0 | 0 |
| 0.385 | -2.64226289 | 0 | 0 | 2.89 | -5.985997753 | 0 | 0 |
| 0.39 | -0.752651408 | 0 | 0 | 2.895 | -2.258940157 | 0 | 0 |
| 0.395 | 1.172341333 | 0 | 0 | 2.9 | 1.851772734 | 0 | 0 |
| 0.4 | 3.061237717 | 0 | 0 | 2.905 | 5.651262363 | 0 | 0 |
| 0.405 | 4.842489768 | 0 | 0 | 2.91 | 8.495548268 | 0 | 0 |
| 0.41 | 6.447225155 | 0 | 0 | 2.915 | 9.9009267 | 0 | 0 |
| 0.415 | 7.81198709 | 0 | 0 | 2.92 | 9.626657083 | 0 | 0 |
| 0.42 | 8.881358569 | 0 | 0 | 2.925 | 7.716750515 | 0 | 0 |
| 0.425 | 9.610360595 | 0 | 0 | 2.93 | 4.493516679 | 0 | 0 |
| 0.43 | 9.966517654 | 0 | 0 | 2.935 | 0.503692312 | 0 | 0 |
| 0.435 | 9.931492136 | 0 | 0 | 2.94 | -3.573935359 | 0 | 0 |
| 0.44 | 9.502202363 | 0 | 0 | 2.945 | -7.043865094 | 0 | 0 |

| | | | | | | | |
|-------|--------------|---|---|-------|--------------|---|---|
| 0.445 | 8.691356284 | 0 | 0 | 2.95 | -9.31260598 | 0 | 0 |
| 0.45 | 7.527354145 | 0 | 0 | 2.955 | -9.99050724 | 0 | 0 |
| 0.455 | 6.053537936 | 0 | 0 | 2.96 | -8.959168083 | 0 | 0 |
| 0.46 | 4.326792214 | 0 | 0 | 2.965 | -6.392684058 | 0 | 0 |
| 0.465 | 2.415529004 | 0 | 0 | 2.97 | -2.728827473 | 0 | 0 |
| 0.47 | 0.397117718 | 0 | 0 | 2.975 | 1.405169383 | 0 | 0 |
| 0.475 | -1.64515189 | 0 | 0 | 2.98 | 5.299725569 | 0 | 0 |
| 0.48 | -3.62546104 | 0 | 0 | 2.985 | 8.284672801 | 0 | 0 |
| 0.485 | -5.459073858 | 0 | 0 | 2.99 | 9.84477953 | 0 | 0 |
| 0.49 | -7.066020172 | 0 | 0 | 2.995 | 9.709089494 | 0 | 0 |
| 0.495 | -8.374689255 | 0 | 0 | 3 | 7.898515469 | 0 | 0 |
| 0.5 | -9.325171133 | 0 | 0 | 3.005 | 4.723239116 | 0 | 0 |
| 0.505 | -9.872185988 | 0 | 0 | 3.01 | 0.730092311 | 0 | 0 |
| 0.51 | -9.98745356 | 0 | 0 | 3.015 | -3.391246115 | 0 | 0 |
| 0.515 | -9.661373407 | 0 | 0 | 3.02 | -6.927212123 | 0 | 0 |
| 0.52 | -8.903912757 | 0 | 0 | 3.025 | -9.263984834 | 0 | 0 |
| 0.525 | -7.744630826 | 0 | 0 | 3.03 | -9.994348499 | 0 | 0 |
| 0.53 | -6.231805619 | 0 | 0 | 3.035 | -8.989131857 | 0 | 0 |
| 0.535 | -4.430669873 | 0 | 0 | 3.04 | -6.420611064 | 0 | 0 |
| 0.54 | -2.420805252 | 0 | 0 | 3.045 | -2.733545501 | 0 | 0 |
| 0.545 | -0.292786117 | 0 | 0 | 3.05 | 1.431385935 | 0 | 0 |
| 0.55 | 1.855795877 | 0 | 0 | 3.055 | 5.348647532 | 0 | 0 |
| 0.555 | 3.924759546 | 0 | 0 | 3.06 | 8.334202236 | 0 | 0 |
| 0.56 | 5.816018318 | 0 | 0 | 3.065 | 9.865160853 | 0 | 0 |
| 0.565 | 7.438303827 | 0 | 0 | 3.07 | 9.671761754 | 0 | 0 |
| 0.57 | 8.711700771 | 0 | 0 | 3.075 | 7.785432316 | 0 | 0 |
| 0.575 | 9.571764427 | 0 | 0 | 3.08 | 4.534279797 | 0 | 0 |
| 0.58 | 9.973003229 | 0 | 0 | 3.085 | 0.486528162 | 0 | 0 |
| 0.585 | 9.89153132 | 0 | 0 | 3.09 | -3.648439099 | 0 | 0 |
| 0.59 | 9.32672951 | 0 | 0 | 3.095 | -7.144259661 | 0 | 0 |
| 0.595 | 8.301796396 | 0 | 0 | 3.1 | -9.385283492 | 0 | 0 |
| 0.6 | 6.863122896 | 0 | 0 | 3.105 | -9.975310531 | 0 | 0 |
| 0.605 | 5.07848086 | 0 | 0 | 3.11 | -8.808114715 | 0 | 0 |
| 0.61 | 3.034076929 | 0 | 0 | 3.115 | -6.087118565 | 0 | 0 |
| 0.615 | 0.830583655 | 0 | 0 | 3.12 | -2.290484754 | 0 | 0 |
| 0.62 | -1.421682445 | 0 | 0 | 3.125 | 1.912484506 | 0 | 0 |
| 0.625 | -3.608214729 | 0 | 0 | 3.13 | 5.77910037 | 0 | 0 |
| 0.63 | -5.616138903 | 0 | 0 | 3.135 | 8.624518277 | 0 | 0 |
| 0.635 | -7.340110828 | 0 | 0 | 3.14 | 9.943260316 | 0 | 0 |
| 0.64 | -8.687980761 | 0 | 0 | 3.145 | 9.4994263 | 0 | 0 |
| 0.645 | -9.585915359 | 0 | 0 | 3.15 | 7.369421515 | 0 | 0 |
| 0.65 | -9.982685887 | 0 | 0 | 3.155 | 3.929371328 | 0 | 0 |
| 0.655 | -9.852864729 | 0 | 0 | 3.16 | -0.210815106 | 0 | 0 |
| 0.66 | -9.198721675 | 0 | 0 | 3.165 | -4.31526033 | 0 | 0 |
| 0.665 | -8.050674511 | 0 | 0 | 3.17 | -7.652811849 | 0 | 0 |
| 0.67 | -6.466222321 | 0 | 0 | 3.175 | -9.627420284 | 0 | 0 |
| 0.675 | -4.527371077 | 0 | 0 | 3.18 | -9.884930272 | 0 | 0 |
| 0.68 | -2.336645245 | 0 | 0 | 3.185 | -8.377090594 | 0 | 0 |
| 0.685 | -0.011861721 | 0 | 0 | 3.19 | -5.371128686 | 0 | 0 |
| 0.69 | 2.320081431 | 0 | 0 | 3.195 | -1.402910018 | 0 | 0 |

| | | | | | | | |
|-------|--------------|---|---|-------|--------------|---|---|
| 0.695 | 4.530083869 | 0 | 0 | 3.2 | 2.818202535 | 0 | 0 |
| 0.7 | 6.49402217 | 0 | 0 | 3.205 | 6.535967617 | 0 | 0 |
| 0.705 | 8.099831305 | 0 | 0 | 3.21 | 9.082795534 | 0 | 0 |
| 0.71 | 9.254081281 | 0 | 0 | 3.215 | 9.999892925 | 0 | 0 |
| 0.715 | 9.887656074 | 0 | 0 | 3.22 | 9.120352392 | 0 | 0 |
| 0.72 | 9.960179725 | 0 | 0 | 3.225 | 6.600061257 | 0 | 0 |
| 0.725 | 9.462894628 | 0 | 0 | 3.23 | 2.890614321 | 0 | 0 |
| 0.73 | 8.419777126 | 0 | 0 | 3.235 | -1.341164695 | 0 | 0 |
| 0.735 | 6.88677163 | 0 | 0 | 3.24 | -5.332831316 | 0 | 0 |
| 0.74 | 4.949131649 | 0 | 0 | 3.245 | -8.363651778 | 0 | 0 |
| 0.745 | 2.716968364 | 0 | 0 | 3.25 | -9.884928958 | 0 | 0 |
| 0.75 | 0.319218136 | 0 | 0 | 3.255 | -9.619722767 | 0 | 0 |
| 0.755 | -2.103657191 | 0 | 0 | 3.26 | -7.613773188 | 0 | 0 |
| 0.76 | -4.407835789 | 0 | 0 | 3.265 | -4.228173066 | 0 | 0 |
| 0.765 | -6.454699229 | 0 | 0 | 3.27 | -0.074846722 | 0 | 0 |
| 0.77 | -8.119285347 | 0 | 0 | 3.275 | 4.09372514 | 0 | 0 |
| 0.775 | -9.298111503 | 0 | 0 | 3.28 | 7.520721217 | 0 | 0 |
| 0.78 | -9.915870142 | 0 | 0 | 3.285 | 9.582499198 | 0 | 0 |
| 0.785 | -9.930551482 | 0 | 0 | 3.29 | 9.902410217 | 0 | 0 |
| 0.79 | -9.336630944 | 0 | 0 | 3.295 | 8.420078782 | 0 | 0 |
| 0.795 | -8.166067772 | 0 | 0 | 3.3 | 5.403320597 | 0 | 0 |
| 0.8 | -6.486990355 | 0 | 0 | 3.305 | 1.400262335 | 0 | 0 |
| 0.805 | -4.400085698 | 0 | 0 | 3.31 | -2.85987123 | 0 | 0 |
| 0.81 | -2.032856768 | 0 | 0 | 3.315 | -6.599414638 | 0 | 0 |
| 0.815 | 0.467947215 | 0 | 0 | 3.32 | -9.134264964 | 0 | 0 |
| 0.82 | 2.945295355 | 0 | 0 | 3.325 | -9.999292924 | 0 | 0 |
| 0.825 | 5.241698448 | 0 | 0 | 3.33 | -9.034123655 | 0 | 0 |
| 0.83 | 7.20928205 | 0 | 0 | 3.335 | -6.413389235 | 0 | 0 |
| 0.835 | 8.719464207 | 0 | 0 | 3.34 | -2.615655505 | 0 | 0 |
| 0.84 | 9.671597829 | 0 | 0 | 3.345 | 1.663547596 | 0 | 0 |
| 0.845 | 9.999985115 | 0 | 0 | 3.35 | 5.638865227 | 0 | 0 |
| 0.85 | 9.678759744 | 0 | 0 | 3.355 | 8.579230844 | 0 | 0 |
| 0.855 | 8.724257763 | 0 | 0 | 3.36 | 9.942512733 | 0 | 0 |
| 0.86 | 7.194653099 | 0 | 0 | 3.365 | 9.475858021 | 0 | 0 |
| 0.865 | 5.186809367 | 0 | 0 | 3.37 | 7.263090815 | 0 | 0 |
| 0.87 | 2.830484934 | 0 | 0 | 3.375 | 3.710189945 | 0 | 0 |
| 0.875 | 0.280210948 | 0 | 0 | 3.38 | -0.528744483 | 0 | 0 |
| 0.88 | -2.29467047 | 0 | 0 | 3.385 | -4.671619745 | 0 | 0 |
| 0.885 | -4.721180504 | 0 | 0 | 3.39 | -7.952566718 | 0 | 0 |
| 0.89 | -6.834360886 | 0 | 0 | 3.395 | -9.763665748 | 0 | 0 |
| 0.895 | -8.488629214 | 0 | 0 | 3.4 | -9.767929065 | 0 | 0 |
| 0.9 | -9.568044404 | 0 | 0 | 3.405 | -7.962479183 | 0 | 0 |
| 0.905 | -9.994746015 | 0 | 0 | 3.41 | -4.679992321 | 0 | 0 |
| 0.91 | -9.734936035 | 0 | 0 | 3.415 | -0.52787395 | 0 | 0 |
| 0.915 | -8.801924519 | 0 | 0 | 3.42 | 3.723802583 | 0 | 0 |
| 0.92 | -7.255952229 | 0 | 0 | 3.425 | 7.284982723 | 0 | 0 |
| 0.925 | -5.200722053 | 0 | 0 | 3.43 | 9.492529589 | 0 | 0 |
| 0.93 | -2.776801909 | 0 | 0 | 3.435 | 9.934004935 | 0 | 0 |
| 0.935 | -0.152289022 | 0 | 0 | 3.44 | 8.525172612 | 0 | 0 |
| 0.94 | 2.488667667 | 0 | 0 | 3.445 | 5.526578515 | 0 | 0 |

| | | | | | | | |
|-------|--------------|---|---|-------|--------------|---|---|
| 0.945 | 4.958719247 | 0 | 0 | 3.45 | 1.495857016 | 0 | 0 |
| 0.95 | 7.080653907 | 0 | 0 | 3.455 | -2.81559951 | 0 | 0 |
| 0.955 | 8.700269731 | 0 | 0 | 3.46 | -6.60253048 | 0 | 0 |
| 0.96 | 9.697840178 | 0 | 0 | 3.465 | -9.156246565 | 0 | 0 |
| 0.965 | 9.997304807 | 0 | 0 | 3.47 | -9.99750639 | 0 | 0 |
| 0.97 | 9.572459803 | 0 | 0 | 3.475 | -8.966869797 | 0 | 0 |
| 0.975 | 8.449622839 | 0 | 0 | 3.48 | -6.255416029 | 0 | 0 |
| 0.98 | 6.706492379 | 0 | 0 | 3.485 | -2.369818924 | 0 | 0 |
| 0.985 | 4.467195744 | 0 | 0 | 3.49 | 1.961934553 | 0 | 0 |
| 0.99 | 1.893803809 | 0 | 0 | 3.495 | 5.926714005 | 0 | 0 |
| 0.995 | -0.825137995 | 0 | 0 | 3.5 | 8.778875033 | 0 | 0 |
| 1 | -3.488273645 | 0 | 0 | 3.505 | 9.980700226 | 0 | 0 |
| 1.005 | -5.896319615 | 0 | 0 | 3.51 | 9.304160682 | 0 | 0 |
| 1.01 | -7.867072347 | 0 | 0 | 3.515 | 6.874668177 | 0 | 0 |
| 1.015 | -9.249406072 | 0 | 0 | 3.52 | 3.148334209 | 0 | 0 |
| 1.02 | -9.935173203 | 0 | 0 | 3.525 | -1.173240899 | 0 | 0 |
| 1.025 | -9.868050736 | 0 | 0 | 3.53 | -5.274809693 | 0 | 0 |
| 1.03 | -9.048585155 | 0 | 0 | 3.535 | -8.381223653 | 0 | 0 |
| 1.035 | -7.534961707 | 0 | 0 | 3.54 | -9.90409789 | 0 | 0 |
| 1.04 | -5.439342515 | 0 | 0 | 3.545 | -9.553612181 | 0 | 0 |
| 1.045 | -2.919958551 | 0 | 0 | 3.55 | -7.394138076 | 0 | 0 |
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| 1.055 | 2.599529733 | 0 | 0 | 3.56 | 0.456252375 | 0 | 0 |
| 1.06 | 5.170934235 | 0 | 0 | 3.565 | 4.660312862 | 0 | 0 |
| 1.065 | 7.341979039 | 0 | 0 | 3.57 | 7.98089133 | 0 | 0 |
| 1.07 | 8.939445978 | 0 | 0 | 3.575 | 9.786100065 | 0 | 0 |
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| 1.105 | 0.490200087 | 0 | 0 | 3.61 | -9.64283063 | 0 | 0 |
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| 1.195 | 8.926498004 | 0 | 0 | 3.7 | -1.648760154 | 0 | 0 |
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| 1.445 | -9.897059104 | 0 | 0 | 3.95 | -1.887099396 | 0 | 0 |
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| 1.65 | -4.948656416 | 0 | 0 | 4.155 | 0.892806934 | 0 | 0 |
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|-------|--------------|---|---|-------|--------------|---|---|
| 1.695 | 5.693175375 | 0 | 0 | 4.2 | 7.660692621 | 0 | 0 |
| 1.7 | 2.612859263 | 0 | 0 | 4.205 | 9.709693314 | 0 | 0 |
| 1.705 | -0.772928134 | 0 | 0 | 4.21 | 9.769515842 | 0 | 0 |
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| 1.76 | 6.601690532 | 0 | 0 | 4.265 | 5.085744903 | 0 | 0 |
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| 1.84 | 0.277934859 | 0 | 0 | 4.345 | 9.997772036 | 0 | 0 |
| 1.845 | 3.712929218 | 0 | 0 | 4.35 | 8.865877272 | 0 | 0 |
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| 1.885 | -0.729851012 | 0 | 0 | 4.39 | -5.222634159 | 0 | 0 |
| 1.89 | -4.15954824 | 0 | 0 | 4.395 | -0.886607002 | 0 | 0 |
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| 1.91 | -9.594871141 | 0 | 0 | 4.415 | 9.830513148 | 0 | 0 |
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| 1.945 | 9.413955654 | 0 | 0 | 4.45 | -9.62785872 | 0 | 0 |
| 1.95 | 9.998683575 | 0 | 0 | 4.455 | -7.414057889 | 0 | 0 |
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| 1.96 | 7.399174121 | 0 | 0 | 4.465 | 0.889536978 | 0 | 0 |
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| 1.99 | -9.735716519 | 0 | 0 | 4.495 | 2.738563026 | 0 | 0 |
| 1.995 | -9.911644274 | 0 | 0 | 4.5 | -1.844083064 | 0 | 0 |
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| 2.02 | 3.752456713 | 0 | 0 | 4.525 | -5.974256078 | 0 | 0 |
| 2.025 | 6.817708083 | 0 | 0 | 4.53 | -1.759045042 | 0 | 0 |
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| 2.035 | 9.960818251 | 0 | 0 | 4.54 | 6.819267945 | 0 | 0 |
| 2.04 | 9.616086236 | 0 | 0 | 4.545 | 9.370726331 | 0 | 0 |
| 2.045 | 7.991752247 | 0 | 0 | 4.55 | 9.942590312 | 0 | 0 |
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| 2.06 | -1.758394306 | 0 | 0 | 4.565 | 0.713927832 | 0 | 0 |
| 2.065 | -5.184117419 | 0 | 0 | 4.57 | -3.827627583 | 0 | 0 |
| 2.07 | -7.916851103 | 0 | 0 | 4.575 | -7.559599967 | 0 | 0 |
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| 2.1 | -0.096099586 | 0 | 0 | 4.605 | 4.825241603 | 0 | 0 |
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| 2.12 | 9.95504884 | 0 | 0 | 4.625 | 7.014987901 | 0 | 0 |
| 2.125 | 9.61783177 | 0 | 0 | 4.63 | 3.070811899 | 0 | 0 |
| 2.13 | 7.961521359 | 0 | 0 | 4.635 | -1.527422091 | 0 | 0 |
| 2.135 | 5.210253248 | 0 | 0 | 4.64 | -5.801413862 | 0 | 0 |
| 2.14 | 1.739803184 | 0 | 0 | 4.645 | -8.840954092 | 0 | 0 |
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| 2.15 | -5.417031449 | 0 | 0 | 4.655 | -9.024641817 | 0 | 0 |
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| 2.16 | -9.689827624 | 0 | 0 | 4.665 | -1.923012526 | 0 | 0 |
| 2.165 | -9.921883909 | 0 | 0 | 4.67 | 2.69241585 | 0 | 0 |
| 2.17 | -8.774945474 | 0 | 0 | 4.675 | 6.734077484 | 0 | 0 |
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| 2.185 | 0.565920956 | 0 | 0 | 4.69 | 8.434260585 | 0 | 0 |
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| 2.195 | 7.240762753 | 0 | 0 | 4.7 | 0.703484486 | 0 | 0 |
| 2.2 | 9.271382791 | 0 | 0 | 4.705 | -3.860441091 | 0 | 0 |
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| 2.22 | 4.293100521 | 0 | 0 | 4.725 | -7.690636183 | 0 | 0 |
| 2.225 | 0.651137345 | 0 | 0 | 4.73 | -3.987769691 | 0 | 0 |
| 2.23 | -3.085981212 | 0 | 0 | 4.735 | 0.570667963 | 0 | 0 |
| 2.235 | -6.387762107 | 0 | 0 | 4.74 | 5.007515026 | 0 | 0 |
| 2.24 | -8.783515452 | 0 | 0 | 4.745 | 8.370799976 | 0 | 0 |
| 2.245 | -9.929764286 | 0 | 0 | 4.75 | 9.938094796 | 0 | 0 |
| 2.25 | -9.659980562 | 0 | 0 | 4.755 | 9.371920915 | 0 | 0 |
| 2.255 | -8.009378244 | 0 | 0 | 4.76 | 6.792728156 | 0 | 0 |
| 2.26 | -5.210992729 | 0 | 0 | 4.765 | 2.753598954 | 0 | 0 |
| 2.265 | -1.663357487 | 0 | 0 | 4.77 | -1.878082581 | 0 | 0 |
| 2.27 | 2.12582535 | 0 | 0 | 4.775 | -6.106738673 | 0 | 0 |
| 2.275 | 5.612122345 | 0 | 0 | 4.78 | -9.022585038 | 0 | 0 |
| 2.28 | 8.292612163 | 0 | 0 | 4.785 | -9.997505488 | 0 | 0 |
| 2.285 | 9.778689118 | 0 | 0 | 4.79 | -8.820612899 | 0 | 0 |
| 2.29 | 9.852852923 | 0 | 0 | 4.795 | -5.744184636 | 0 | 0 |
| 2.295 | 8.501122864 | 0 | 0 | 4.8 | -1.429899496 | 0 | 0 |
| 2.3 | 5.916166323 | 0 | 0 | 4.805 | 3.193235002 | 0 | 0 |
| 2.305 | 2.470437318 | 0 | 0 | 4.81 | 7.128811702 | 0 | 0 |
| 2.31 | -1.337021953 | 0 | 0 | 4.815 | 9.527807968 | 0 | 0 |
| 2.315 | -4.952588238 | 0 | 0 | 4.82 | 9.871919052 | 0 | 0 |
| 2.32 | -7.848523837 | 0 | 0 | 4.825 | 8.085815024 | 0 | 0 |
| 2.325 | -9.600213496 | 0 | 0 | 4.83 | 4.553948606 | 0 | 0 |
| 2.33 | -9.948839051 | 0 | 0 | 4.835 | 0.038098603 | 0 | 0 |
| 2.335 | -8.840182323 | 0 | 0 | 4.84 | -4.486730186 | 0 | 0 |
| 2.34 | -6.433660425 | 0 | 0 | 4.845 | -8.04274494 | 0 | 0 |
| 2.345 | -3.08001767 | 0 | 0 | 4.85 | -9.86073663 | 0 | 0 |
| 2.35 | 0.729300548 | 0 | 0 | 4.855 | -9.546676248 | 0 | 0 |
| 2.355 | 4.433859725 | 0 | 0 | 4.86 | -7.167408958 | 0 | 0 |
| 2.36 | 7.486616326 | 0 | 0 | 4.865 | -3.236746345 | 0 | 0 |
| 2.365 | 9.434868733 | 0 | 0 | 4.87 | 1.395222416 | 0 | 0 |
| 2.37 | 9.987776388 | 0 | 0 | 4.875 | 5.725813853 | 0 | 0 |
| 2.375 | 9.060321649 | 0 | 0 | 4.88 | 8.816774341 | 0 | 0 |
| 2.38 | 6.786992075 | 0 | 0 | 4.885 | 9.997677161 | 0 | 0 |
| 2.385 | 3.502902467 | 0 | 0 | 4.89 | 9.01157375 | 0 | 0 |
| 2.39 | -0.305093283 | 0 | 0 | 4.895 | 6.07120497 | 0 | 0 |
| 2.395 | -4.070247223 | 0 | 0 | 4.9 | 1.813410548 | 0 | 0 |
| 2.4 | -7.230167779 | 0 | 0 | 4.905 | -2.838560539 | 0 | 0 |
| 2.405 | -9.310967446 | 0 | 0 | 4.91 | -6.875121291 | 0 | 0 |
| 2.41 | -9.99869694 | 0 | 0 | 4.915 | -9.41946994 | 0 | 0 |
| 2.415 | -9.187244902 | 0 | 0 | 4.92 | -9.918201679 | 0 | 0 |
| 2.42 | -6.995318445 | 0 | 0 | 4.925 | -8.261936576 | 0 | 0 |
| 2.425 | -3.749705294 | 0 | 0 | 4.93 | -4.809613486 | 0 | 0 |
| 2.43 | 0.062924909 | 0 | 0 | 4.935 | -0.310989948 | 0 | 0 |
| 2.435 | 3.868652282 | 0 | 0 | 4.94 | 4.255981476 | 0 | 0 |
| 2.44 | 7.092584949 | 0 | 0 | 4.945 | 7.897671458 | 0 | 0 |

| | | | | | | | |
|-------|--------------|---|---|-------|--------------|---|---|
| 2.445 | 9.245832109 | 0 | 0 | 4.95 | 9.821021211 | 0 | 0 |
| 2.45 | 9.999995807 | 0 | 0 | 4.955 | 9.606441691 | 0 | 0 |
| 2.455 | 9.237779335 | 0 | 0 | 4.96 | 7.299627786 | 0 | 0 |
| 2.46 | 7.071836698 | 0 | 0 | 4.965 | 3.402136454 | 0 | 0 |
| 2.465 | 3.828750483 | 0 | 0 | 4.97 | -1.237400749 | 0 | 0 |
| 2.47 | 0.000312907 | 0 | 0 | 4.975 | -5.607892272 | 0 | 0 |
| 2.475 | -3.830704454 | 0 | 0 | 4.98 | -8.756102175 | 0 | 0 |
| 2.48 | -7.079142484 | 0 | 0 | 4.985 | -9.994666617 | 0 | 0 |
| 2.485 | -9.246959668 | 0 | 0 | 4.99 | -9.052393567 | 0 | 0 |
| 2.49 | -9.999941948 | 0 | 0 | 4.995 | -6.133932058 | 0 | 0 |
| 2.495 | -9.219750098 | 0 | 0 | 5 | -1.875619637 | 0 | 0 |
| 2.5 | -7.023122175 | 0 | 0 | | | | |

Los gráficos de cada bloque:

Bloque 5

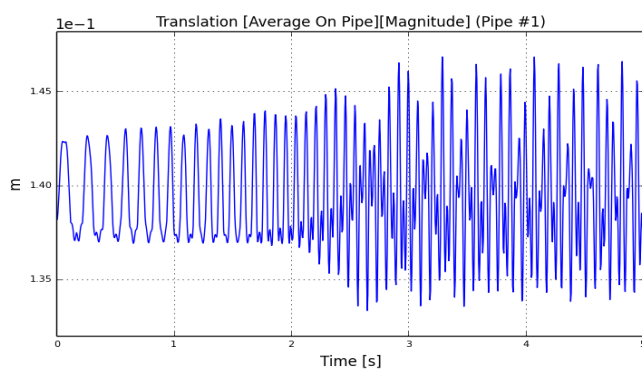


Figura 126. Traslado (promedio en el tubo)

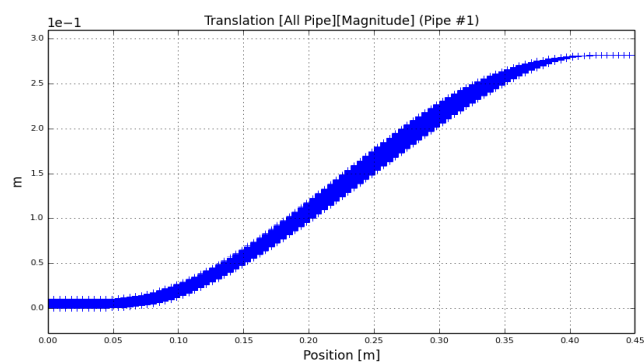


Figura 127. Traslado (todo el tubo)

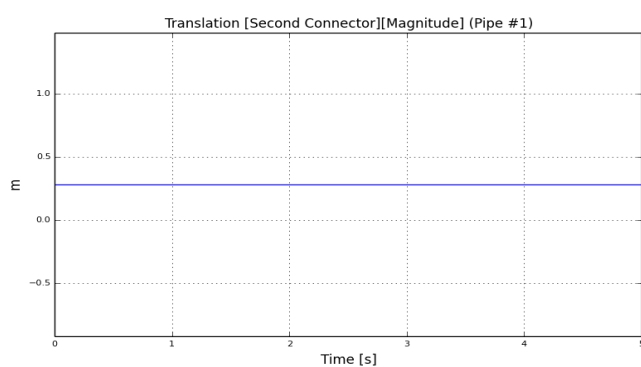


Figura 128. Traslado

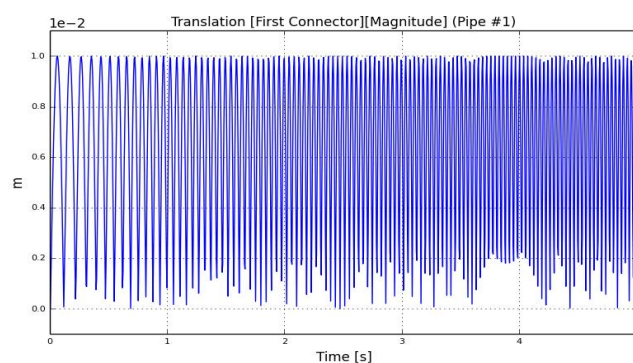


Figura 129. Traslado

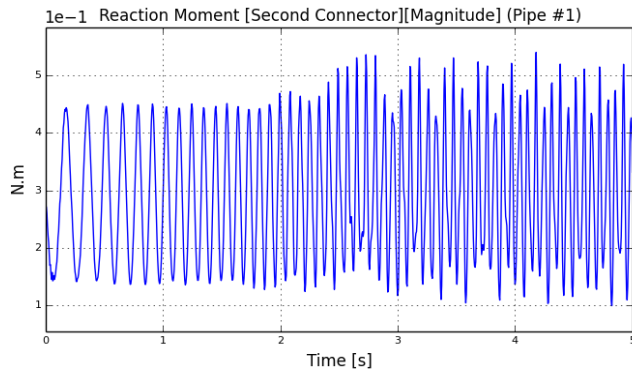


Figura 130. Momento de reacción

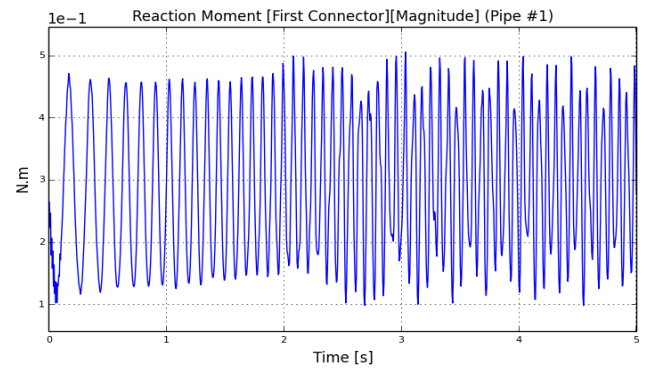


Figura 131. Momento de reacción

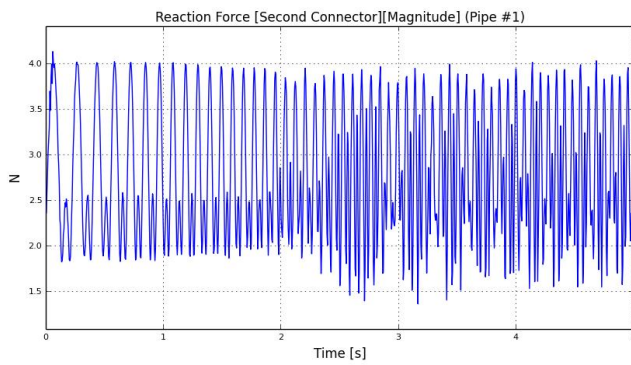


Figura 132. Fuerza de reacción

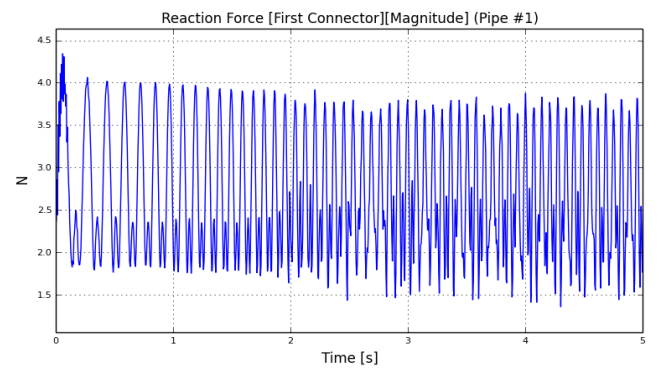


Figura 133. Fuerza de reacción

Bloque 7

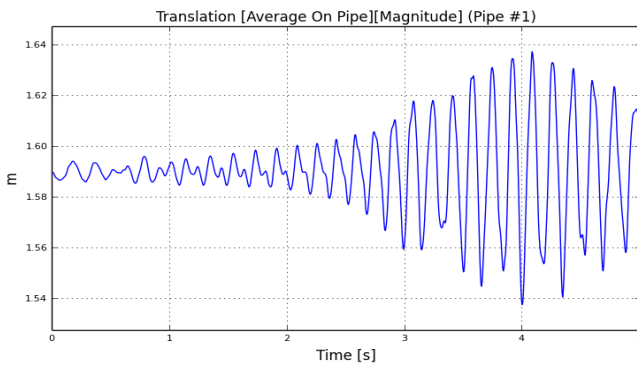


Figura 134. Traslado (promedio en el tubo)

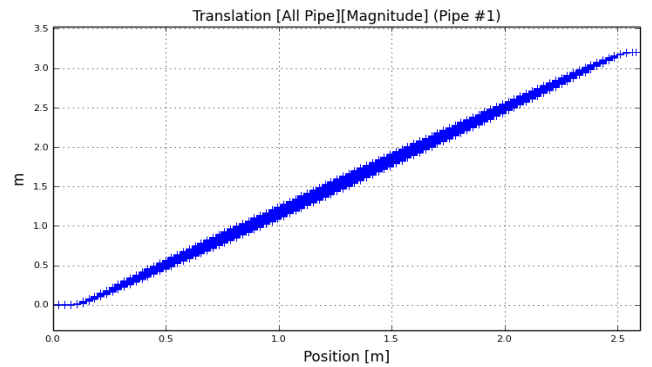


Figura 135. Traslado (todo el tubo)

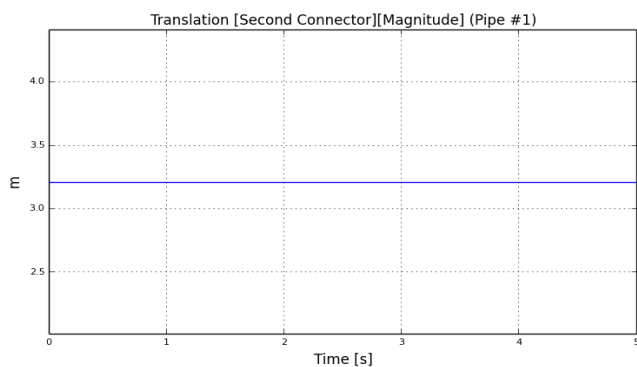


Figura 136. Traslado

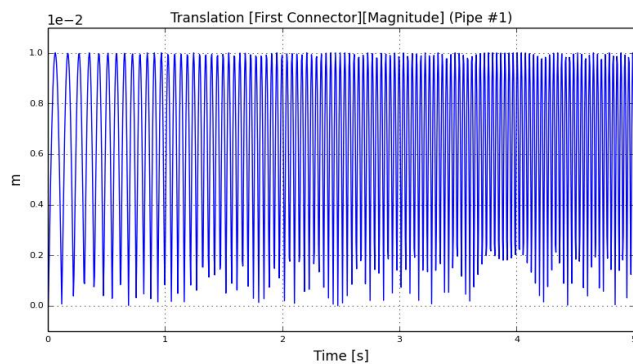


Figura 137. Traslado

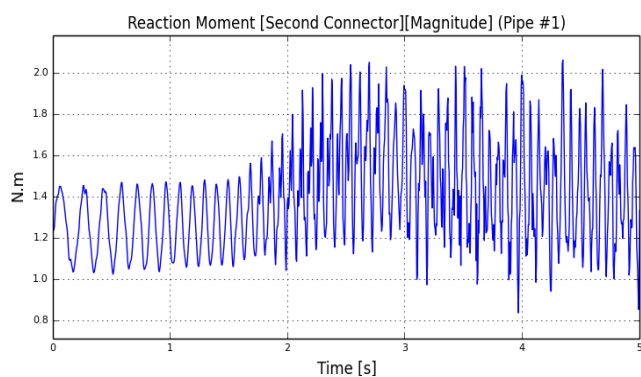


Figura 138. Momento de reacción

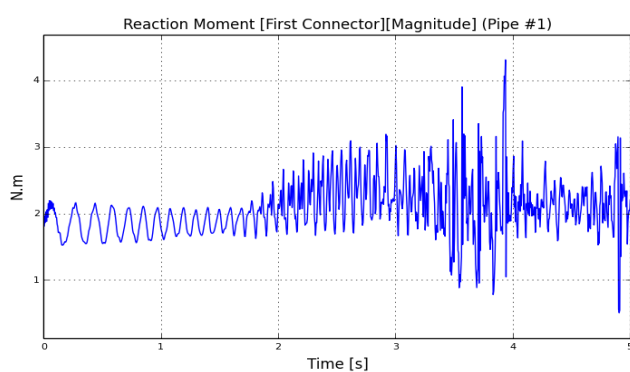


Figura 139. Momento de reacción

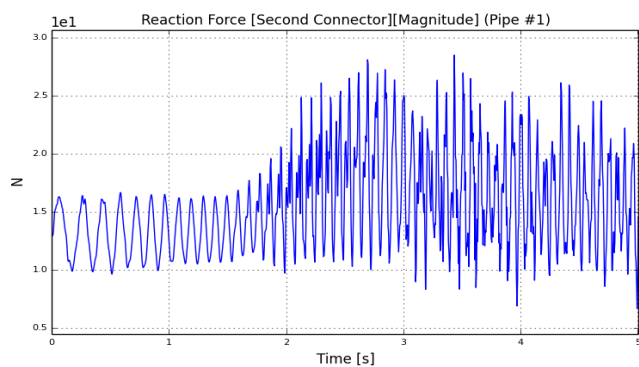


Figura 140. Fuerza de reacción

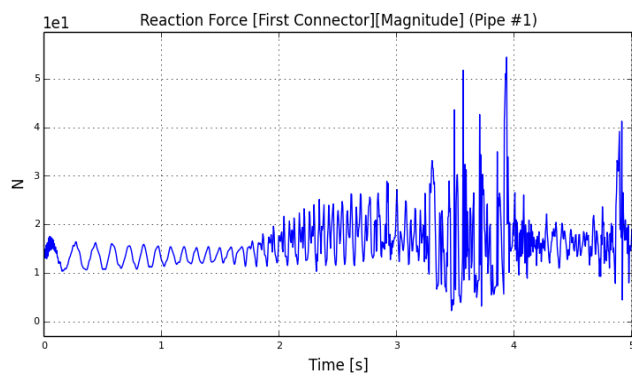


Figura 141. Fuerza de reacción