***MATLAB, Lab 9 – Individual work***

The table below presents the blood pressure registered in aorta during single heartbeat cycle.

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| --- | --- |
| time | pressure |
| [s] | [mmHg] |
| 0 | 87.5 |
| 0.04 | 86.8 |
| 0.08 | 84.8 |
| 0.12 | 83.3 |
| 0.16 | 98.0 |
| 0.20 | 111.0 |
| 0.24 | 116.0 |
| 0.28 | 120.4 |
| 0.32 | 121.9 |
| 0.36 | 119.8 |
| 0.40 | 116.2 |
| 0.44 | 109.5 |
| 0.48 | 107.0 |
| 0.52 | 106.8 |
| 0.56 | 106.0 |
| 0.60 | 104.2 |
| 0.64 | 101.7 |
| 0.68 | 99.6 |
| 0.72 | 99.8 |
| 0.76 | 96.3 |
| 0.80 | 94.7 |
| 0.84 | 94.7 |
| 0.88 | 90.7 |
| 0.92 | 89.4 |
| 0.96 | 89.0 |
| 1.00 | 88.2 |
| 1.04 | 88.0 |
| 1.08 | 87.8 |
| 1.12 | 87.7 |
| 1.16 | 87.6 |
| 1.20 | 87.6 |

1. Recalculate the pressure into Pascals. Plot the graph showing this dependency

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| Screenshot: |
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1. How many complex Fourier coefficients will be obtained after applying fft function to the data presented above? Are all of them necessary to obtain the complete set of Fourier coefficients an bn?

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| Answer: |
| We obtain thirty one complex Fourier coefficients after using fft function.  The number of them that are useful to obtain the complete set of Fourier coefficients are sixteen. We can see this number in the following line of code:  n= floor ((N+1)/2);)  We need more or less half of complex Fourier coefficients because the rest of them are the conjugates of these already given. |

1. Use fft function to obtain the full set of an and bn coefficients. Add as many rows as necessary. Hint: it is not necessary to rewrite the values of coefficients manually, you may view any Matlab variable in a spreedsheat, copy and paste.

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| --- | --- | --- | --- |
| a1 | -0.393352110165664 | b1 | -0.0400000000000000 |
| a2 | -0.194642253866759 | b2 | -0.0400000000000000 |
| a3 | -0.127489217365622 | b3 | -0.0400000000000000 |
| a4 | -0.0932110224514016 | b4 | -0.0400000000000001 |
| a5 | -0.0720661924863809 | b5 | -0.0400000000000000 |
| a6 | -0.0574695682007153 | b6 | -0.0400000000000000 |
| a7 | -0.0465944228728718 | b7 | -0.0400000000000000 |
| a8 | -0.0380228352828733 | b8 | -0.0400000000000000 |
| a9 | -0.0309623046816312 | b9 | -0.0400000000000000 |
| a10 | -0.0249321906396207 | b10 | -0.0400000000000001 |
| a11 | -0.0196209367249667 | b11 | -0.0400000000000000 |
| a12 | -0.0148143732629913 | b12 | -0.0400000000000000 |
| a13 | -0.0103567175537536 | b13 | -0.0400000000000000 |
| a14 | -0.00612777460957107 | b14 | -0.0400000000000000 |
| a15 | -0.00202857040912162 | b15 | -0.0400000000000000 |

1. Create plot of the Fourier series containing first n elements an and bn. Add data points from the first table and print the plot
   1. n=3

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| Screenshot: |
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1. n=6

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| Screenshot: |
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1. all Fourier coefficients obtained in fft

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| Screenshot: |
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1. with the use of function stem, create plots presenting the amplitudes an and bn. Give some comments on number of amplitudes necessary to reconstruct the signal with reasonable accuracy.

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| Screenshots: |
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| Comments: |
| The number of amplitudes an and bn useful to reconstruct the signal with a really high accuracy is half of the number of complex Fourier coefficients that We obtain after using fft function.  We only need half of them because of as a complex numbers, the other half of them are symmetrical conjugates of elements from the first half. |