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| **ECE 3300 EXAM 3 NOTES SHEET Revision 20** | | | | | | | | | |
| **Fourier Transform of a signal x(t) or x[n]** | | | | | | |  | | is a correlation of with  is a correlation of with |
| is **not** periodic, in general. | is periodic with period | | | | | |
|  | | | **Example with u[n]** F2015,#6  Given F.T. of , determine F.T. of  **(Delete this text box)**  This part should be handwritten if you are going to use it on your notes sheet! | | | | F.T.’s of and | | |
| **Inverse Fourier Transform of**    **Parseval’s Energy Relationships**  Energy depends on F.T. solely through the magnitude | | | | | | | Determine inverse F.T. of , where a>0      **Power in a Harmonic and in a Freq. Band**     * The power in a frequency band can be determined by summing the powers of the harmonics that lie in that band. The *k*th harmonic has frequency or | | |
| Determine Inverse F.T. of    rect[n or t): | | | | | | |
|  | | | | | **Fourier Transform of Sine/Cosine**  **Note**: For cosine, only the sin (in red) changes  **Note 2**: See **Unrelated Note** below for discrete time | |  | | |
|  | | | | | | **Error of Truncated F.S. Expan.** |  | | |
| **Fourier Transforms of Periodic Signals** | | | **Parsevals’s Power Relationships** | | | | * If is real-valued: is even. * If is real-valued: is even. * For real-valued signals, all of the information in the magnitude of the F.T. is contained in the positive frequencies   **---------------------------------------Unrelated Note-----------------------------------------** | | |
| **Basic Building Blocks For Magnitude Calculations**  🡪  **Example Modulation** | | | | **Effects of Modulation**    Determine **Magnitude** **of F.T.** of , if a>0, and , if -1<a<1. | | | | **Advanced Fourier Transforms**  , | |
|  | | | | (Parseval’s) | | | | **Energy in Frequency Band**  The energy in the frequency band is [ is defined as:  Where  Where  If x(t) or x[n] is real-valued: | |
| **Example of Calculation of Energy in a Frequency Band** | | | | To remove ambiguity in the description and plots of and the phase should always be between and , including but not . | | | | **Phase of the F.T. of Real Signals**   * If is real-valued: is odd. * If is real-valued: is odd. * For real-valued signals, all of the information in the phase of the Fourier transform is contained in the positive frequencies   **Phase of the F.T. of Real Even Signals**   * If is real and even, is always 0 and . 0 if positive, if negative. * For real, even signals, the entire F.T. is real.   **Phase of the F.T. of Real Odd Signals**   * If is real and odd, is always (if negative) and (if positive) * For real, odd signals, the entire F.T. is purely imaginary. | |
| **Example** F2016,#12  Suppose has period and Fourier series coefficients if and otherwise. Determine the percentage of power in the frequency band [3,7].  **(Delete this text box)**  This part should be handwritten if you are going to use it on your notes sheet! | | | | **Time Shifting and Phase**     * Time shifting has no effect on the magnitude of the Fourier transform * The phase alone contains information about the location of a signal in time   **Important Identity** | | | | **Fourier Series Coefficients**     * The 0th harmonic is called DC * The 1st harmonic is called the fundamental frequency   The power in a frequency band can be determined by summing the powers of the harmonics that lie in that band. The *k*th harmonic has frequency or | |
|  | | **Fourier Series Coefficients and Periodicity**  For the s are not periodic in general  For , the s are periodic with period  **Fourier Series expansion:**    Where s are the Fourier series coefficients | | | | | | Example of the phase of a real odd signal | |
| **Error of the Truncated Fourier Series Expansion**    **Truncated Fourier Series Expansion** | | **Quick formula to find :**  **Example** S2016,#7  Using definition of F.T.: Find of .  This uses an unlisted property!  F2015,#4 MSE | | | | | | **Example of Fourier Transform Determination**    **Magnitude Thing**:  **F.T. Thing:** | |

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| ***DON’T PRINT THIS PAGE*** |  |
|  | Suppose is a real, even, signal, and suppose . At what ranges does equal zero? |
|  | Suppose has a period and Fourier series coefficients ; all other are zero. Determine the percentage of power in the second harmonic. |
|  | Determine the inverse Fourier transformer of . |