**Chap 4.2: Fourier Transform**

1. **The Fourier Transform**
2. **The Fourier Integral**

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| Fourier Integral | * Fourier integral representation of : * If is an even function then we have the **Fourier cosine integral**: * If is an odd function then we have the **Fourier sine integral**: |
| Fourier Transform Pair | * Fourier integral may be written in the form of the pair of equations * The Fourier transform of the function : * The inverse Fourier transform of : |
| Fourier Transform Table | * Table of usually used Fourier Transform pairs:  |  |  | | --- | --- | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |

1. **The continuous Fourier Spectra**

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| Definition | * can be expressed in the exponential form: * is also known as the (complex) frequency spectrum of   + : is the **amplitude**   + : is the **phase spectra** * Table of usually used amplitude & phase spectra:  |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |

1. **Fourier Transform Properties**
2. **Linearity property**

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| Linearity | * If:   + is a function having Fourier transforms and a constant   + is a function having Fourier transforms and a constant * Then: |

1. **Time-differentiation property**

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| Time-differentiation | If is a function having Fourier transforms |
| Example |  |

1. **Time-shift property**

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| Time-shift | If is a function having Fourier transforms |

1. **Frequency-shift property**

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| Frequency-shift | If is a function having Fourier transforms |

1. **Transforms of the step and impulse functions**
2. **Energy and power**

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| Energy | The total energy associated with the signal :   * + : is the **energy spectral density** |
| Power | The average power P of the signal |

1. **Convolution**

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| Convolution in time | * If:   + is a function having Fourier transforms   + is a function having Fourier transforms * Then: |
| Convolution in frequency | * f:   + is a function having Fourier transforms   + is a function having Fourier transforms * Then: |