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Math 362 Fourier Analysis

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Class Prep 3

Section 3.1

Key Concepts: In this section we examine inner products and orthogonality of functions. We compute similarity coefficients using inner products, and learn how this value provides a measure of how similar a function “f” is to a second function g, where g has known properties of interest.

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| --- | --- |
| Input | Output Commands |
| >> InnerProdSinCos(0,1,-1,1)  innerprod =  -2.3568e-17 |  |
| >> SimilaritySineChord(440,554)  C1 =  3.0000  C2 =  2.0000 |  |
| >> InnerProd2Step(0,1,-2,6)  innerprod =  9.4988 |  |

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| --- | --- |
| >> Similarity2Step(0,1,-2,8)  C =  0.9694 |  |
| >> Similarity4Step(0,1,-2,6)  C =  1.1072 |  |
| >> SimilarityCosCos(0,1,-1,1)  C =  1.0076 |  |
| >> SimilaritySawSine(0,1,-1,1)  C =  -0.6366 |  |

Section 3.2

Key Concepts: A transform is used to change raw signal data into a more usable format. We will learn what a function expansion is and define the transform of a signal “f” to be the vector of similarity coefficients used in the expansion. We will use MATLAB to compute the transform of some basic signals “f” relative to box function expansions, Haar wavelet expansions, and Legendre polynomial expansions.

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| --- | --- |
| Input | Output Command |
| >> BoxExpansionSawtooth(-1,1)  coeffs =  -0.7510 -0.2510 0.2490 0.7490 |  |
| >> boxfcns |  |
| >> BoxLinear(0,2.5)  coeffs =  1.1245 1.3745 1.6245 1.8745 |  |
| >> BoxTent(0,1)  coeffs =  0.2490 0.7490 0.7510 0.2510 |  |

|  |  |
| --- | --- |
| >> haar4plot |  |
| >> HaarSawtooth(-1.2,1.2)  c =  -0.0010  -0.5000  -0.2500  -0.2500 |  |
| >> HaarPoly(0,0.26)  c =  0.1667  -0.0006  -0.0628  0.0622 |  |
| >> haar8plot |  |
| >> legendreplot |  |

|  |  |
| --- | --- |
| >> LegendrePoly(-12,1.2,8)  c =  -8.0000  0.0000  8.0000  0.0000  0.0000  -0.0000  0.0000  0.0000  0.0001 |  |
| >> LegendreSine(-1.2,1.2,1)  c =  0.0000  -0.4775 |  |
| >> LegendreSine(-1.2,1.2,3)  c =  0.0000  -0.4775  0.0000  -0.6908 |  |
| >> LegendreSine(-1.2,1.2,5)  c =  0.0000  -0.4775  0.0000  -0.6908  0.0000  1.8440 |  |

|  |  |
| --- | --- |
| >> LegendreSine(-1.2,1.2,8)  c =  0.0000  -0.4775  0.0000  -0.6908  0.0000  1.8440  -0.0000  -0.8235  -0.0000 |  |