Fourier cosine transform

Next: Fourier Transformation of The Standard Up: No Title Previous: Physical Interpretation of Fourier The Fourier Transformation Pair is = = x(t) = = When the signal is even x(-t)=x(t), its spectrum is also even, and the integrity of the term it contains (a strange function) both forward and inverse transforms above is odd, and the corresponding integral is zero. The Fourier transformation pair becomes a cosine transformation: When the signal is strange x(-t)=-x(t), its spectrum is also strange and the embedded of the term it contains (an even function) in both the front and reverse transformation above is odd and the corresponding integral is zero. The Fourier transformation pair becomes: If we determine the second equation, the above two equations that we have the sine transformation pair are made: We see that when x(t)=-x(-t), the sine transformation is related to the Fourier transformation by or The sine and cosine transformations are useful when the given x(t) function is known to be either uniform or strange. In addition, as cosine and sine transformation are real functions (while Fourier transformation is complex), they can be applied more efficiently and widely used in various applications. For example, discrete cosine transformation is used in the image compression template called JPEG. Example: If x(t)=x(t)u(t), that is, x(t)=0 when t<0, then x(t) can be extended to t<0 half either evenly or oddly, and x(t) can be expressed as xex(t) and xox(t) cancel each other when t<0. Assuming then Next: Fourier transform the typical Up: No Title Previous: Physical Interpretation of Fourier Ruye Wang 2001-11-07 Variation Fourier transformsIn mathematics, the furier sine and cosine transformations are forms of Fourier integral transformation that do not use complex numbers. These are the formats originally used by Joseph Fourier and are still preferred in some applications, such as signal processing or statistics. [1] Definition The tetraenide transformation of f (t) is sometimes declared either by f ^ s {\displaystyle {\hat {\f}}^s}} or by F s (f) {\displaystyle {\mathcal {F}}}_{s}_f)} , is f ^ s ^ n) = ∫ − ∞ ∞ f (t) sin (2 p t t . {\displaystyle {\hat {f}}^{s}(u)=\int _{-\infty }^{\infty }f(t)\sin(2\pi u t)\,dt.} If t means time, then n is the frequency in cycles per unit of time, but in the abstract, it can be any pair of variables that are duplicated between them. This transformation is necessarily a strange function of frequency, i.e. for all n: f ^ s (− n) = − f ^ s (n) . {\hat {f}}^{s}(-u)=-{\hat {f}}^{s}(u).} The numeric factors in Fourier transformations are uniquely defined only by their product. Here, for the Fourier inversion formula not to have a numeric factor, the factor 2 is displayed because the sine function has rule L2 of rule 1 2 . {\screen style {\tfrac {1}{\sqrt {2}}}}}}}} Fourier cosine transformation of f (t) is sometimes declared either by f ^ c {\displaystyle {\displaystyle {f} ∞ ∞ ∫} {\displaystyle {\hat {f}}^{c}(u)=\int _{-\infty }^{\infty }f(t)\cos(2\pi u t)\,dt.} It is necessarily a uniform function of frequency, i.e. for all n: f ^ c (n) = f ^ c (− n). {\display style {\hat {f}}^{c}(u)={\hat {f}}^c} (-u).} Some authors[2] define only the cosine transformation for uniform T functions, so its sine transformation is zero. Since the cosine is also uniform, a simpler formula can be used, f ^ c (n) = 2 ∫ 0 ∞ f (t) cos (2 n t) d t . {\displaystyle {\hat {f}}^{c}(u)=2\int _{0}^{\infty }f(t)\cos(2\pi u t)\,dt.} Similarly, if f is a strange function, then the cosine transformation is zero and the sine transformation can be simplified to f ^s (n) = 2 ∫ 0 ∞ f (t) sin (2 n t) d t . {\displaystyle {\hat {f}}^{s}(u)=2\int _{0}^{\infty }f(t)\sin(2\pi u t)\,dt.} Other authors also define the transformation of the cosine as[3] f ^ c (n) = 2 p ∫ 0 ∞ f (t) cos (2 p n t) d t . {\displaystyle {\hat {f}}^{c}(u)={\sqrt {\frac {2}{\pi }}}\int _{0}^{\infty }f(t)\cos(2\pi u t)\,dt.} and sine as f ^ s (n) = 2 p ∫ 0 ∞ f (t) sin (2 p n t) d t . {\displaystyle {\hat {f}}^{s}(u)={\sqrt {\frac {2}{\pi }}}\int _{0}^{\infty }f(t)\sin(2\pi u t)\,dt.} Four-fold reversal The initial function f can be recovered from its transformation according to the usual assumptions, that f both its transformations should be completely integrable. For more details on the various hypotheses, see Fourier Reversal Theorem. The type of reversal is[4] f (t) = ∫ − ∞ ∞ f ^ c (n) cos (2 n t) d n + ∫ − ∞ ∞ f ^ s (n) sin (2 p n t) d , {\displaystyle f(t)=\int _{-\infty }^{\infty }{\hat {f}}^c}(u)\cos(2\pi u t)\,du +\int _{-\infty }^{\infty }{\infty }{\infty }{\hat {f}^}{s}\sin(2\pi u t)\ \ ,du ,) which has the advantage that all quantities are real. Using the addition type for cosine, this can be rewritten as f (t) = ∫ − − − ∞ ∞ ∫ − ∞ ∞ f (x) cos (2 n (x − t)) d x d n . {\displaystyle f(t)=\int _{-\infty }^{\infty }\int _{-\infty }^{\infty }^{\infty }f(x)\cos(2\pi u (x-t))\,dx\,du .} If the original function f is a uniform function, then the sine transformation is zero. If f is a strange function, then the cosine transformation is zero. In both cases, the inversion formula simplifies. Relationship with complex exponentials The form of the Fourier transformation most commonly used today is f ^ (n) = ∫ − ∞ ∞ f (t) e − 2 p i n t d t = ∫ − ∞ ∞ f (t) (cos (2 n t) − i sin (2 n t)) d t Type of = (∫ − ∞ ∞ f (t) cos (2 π ν t) d t) − i (∫ − ∞ ∞ f (t) sin (2 π ν t t) d t) = f ^ c (ν) − i f ^ s (ν) {\displaystyle {\begin{στοιχισμένο}{\hat {f}}(u)&=\int)&=\int }^{\infty }f(t)e^{-2\pi iu t}\,dt\\&=\int _{-\infty }^{\infty }f(t)(\cos(2\pi u t)-i\,\sin(2\pi u t))\,dt&&{\text{Euler's Formula}}\\&=\left(\int _{-\infty }^{\infty }f(t)\cos(2\pi u t)\,dt\right)-i\left(\int _{-\infty }^{\infty }f(t)\sin(2\pi u t)\,dt\right)\\&={\hat {f}}^{c}(u)-i{\hat {f}}^{s}(u)\end{aligned}}} Numerical Evaluation Using standard methods of numerical evaluation for Fourier integrals, such as Gaussian or tanh-sinh quadrature, is likely to lead to completely incorrect results, as the quadrature sum is (for most integrands of interest) highly ill-conditioned. Specific numerical methods are required that take advantage of the oscillation structure, an example of which is the Uura method for Fourier integrals[5] This method attempts to evaluate the integrand at points that asymptotically approach the oscillation zeros (either the sine or the cosine), quickly reducing the size of the positive and negative terms that are aggregated. See also Discrete cosine convert Discrete sine convert Whittaker references, Edmund, and James Watson, A Course in Modern Analysis, Fourth Edition, Cambridge Univ. Press, 1927, p. 189, 211 ^ Highlights in the History of Fourier Transformation. pulse.embs.org. Retrieved 2018-10-08. ^ Mary L. Boas, Mathematical Methods in Natural Sciences, 2nd Ed, John Wiley & Sons Inc., 1983. ISBN 0-471-04409-1 ^ Fourier transformation, cosine and semi-legal transformations. cnyack.homestead.com. Retrieved 2018-10-08. ^ Poincare, Henri (1895). Theorie analytique de la defently de chaleur. Paris: G. Carré. 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