НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ

«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ

імені Ігоря Сікорського»

Кафедра прикладної математики

Звіт

із лабораторної роботи №*8*

із дисципліни «Аналіз даних»

|  |  |  |
| --- | --- | --- |
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Київ — 2019

**Тема:** Дослідження вейвлет – перетворення

**Мета роботи:** здобути практичні навички побудови вейвлет – базису для заданого батьківського вейвлету.

**Завдання.** Побудувати вейвлет - базис для заданого батьківського вейвлету. Порівняти результати для різних батьківських вейвлетів.

**Код програми та результати його виконання:**

>

> n=1000

>

> x=linspace(-5, 5, n)

>

> #Вейвлет Хаара

> y\_haar <- function(x) if((0<=x)&(x<=1/2)) y=1 else if((1/2<=x)&(x<1)) y=-1 else y=0

> y\_x <- array(n)

>

> for (i in 1:n) {

+ y\_x[i]=y\_haar(x[i])

+ }

>

> plot(x,y\_x,type = "l",col=60,main="Вейвлет Хаара")

> #Вейвлет Шенона

> sinc <- function(x)sin(pi\*x)/(pi\*x)

> y\_shannon <- function(x) sinc(x/2)\*cos(3/2\*pi\*x)

> y\_x <- array(n)

>

> for (i in 1:n) {

+ y\_x[i]=y\_shannon(x[i])

+ }

> fft(y\_x, inverse = TRUE)

[1] -6.036754e+00+0.000000e+00i -6.217813e+00+1.953390e-02i

[3] -6.848536e+00+4.303119e-02i -8.331384e+00+7.852377e-02i

[5] -1.245892e+01+1.565717e-01i -5.313556e+01+8.347201e-01i

[7] 1.047700e+02-1.975103e+00i -9.976429e+01+2.194285e+00i

[9] 9.698368e+01-2.437979e+00i -1.075467e+02+3.041622e+00i

[11] 5.175265e+01-1.626392e+00i 9.492832e+00-3.281794e-01i

[13] 5.232631e+00-1.973590e-01i 3.560417e+00-1.454908e-01i

[15] 2.664186e+00-1.172526e-01i 2.104582e+00-9.924956e-02i

[17] 1.722110e+00-8.663566e-02i 1.444657e+00-7.722834e-02i

[19] 1.234712e+00-6.989583e-02i 1.070765e+00-6.399028e-02i

[21] 9.395690e-01-5.911267e-02i 8.325037e-01-5.500296e-02i

[23] 7.437147e-01-5.148388e-02i 6.690843e-01-4.843009e-02i

[25] 6.056317e-01-4.575028e-02i 5.511464e-01-4.337616e-02i

[27] 5.039554e-01-4.125558e-02i 4.627696e-01-3.934792e-02i

[29] 4.265804e-01-3.762105e-02i 3.945879e-01-3.604919e-02i

[31] 3.661500e-01-3.461137e-02i 3.407457e-01-3.329033e-02i

[33] 3.179482e-01-3.207176e-02i 2.974047e-01-3.094364e-02i

[35] 2.788213e-01-2.989584e-02i 2.619514e-01-2.891971e-02i

[37] 2.465868e-01-2.800783e-02i 2.325503e-01-2.715380e-02i

[39] 2.196906e-01-2.635208e-02i 2.078776e-01-2.559782e-02i

[41] 1.969990e-01-2.488677e-02i 1.869574e-01-2.421517e-02i

[43] 1.776679e-01-2.357973e-02i 1.690562e-01-2.297749e-02i

[45] 1.610571e-01-2.240583e-02i 1.536132e-01-2.186240e-02i

[47] 1.466737e-01-2.134509e-02i 1.401934e-01-2.085200e-02i

[49] 1.341324e-01-2.038142e-02i 1.284549e-01-1.993178e-02i

[51] 1.231288e-01-1.950169e-02i 1.181255e-01-1.908984e-02i

[53] 1.134192e-01-1.869508e-02i 1.089866e-01-1.831632e-02i

[55] 1.048067e-01-1.795260e-02i 1.008606e-01-1.760299e-02i

[57] 9.713092e-02-1.726667e-02i 9.360208e-02-1.694289e-02i

[59] 9.025979e-02-1.663092e-02i 8.709105e-02-1.633011e-02i

[61] 8.408395e-02-1.603987e-02i 8.122762e-02-1.575963e-02i

[63] 7.851208e-02-1.548886e-02i 7.592818e-02-1.522708e-02i

[65] 7.346748e-02-1.497384e-02i 7.112225e-02-1.472871e-02i

[67] 6.888532e-02-1.449130e-02i 6.675009e-02-1.426125e-02i

[69] 6.471047e-02-1.403819e-02i 6.276079e-02-1.382182e-02i

[71] 6.089582e-02-1.361183e-02i 5.911070e-02-1.340792e-02i

[73] 5.740092e-02-1.320984e-02i 5.576227e-02-1.301733e-02i

[75] 5.419086e-02-1.283015e-02i 5.268303e-02-1.264808e-02i

[77] 5.123539e-02-1.247090e-02i 4.984476e-02-1.229841e-02i

[79] 4.850818e-02-1.213042e-02i 4.722287e-02-1.196676e-02i

[81] 4.598624e-02-1.180726e-02i 4.479585e-02-1.165175e-02i

[83] 4.364941e-02-1.150008e-02i 4.254478e-02-1.135210e-02i

[85] 4.147995e-02-1.120769e-02i 4.045303e-02-1.106670e-02i

[87] 3.946222e-02-1.092901e-02i 3.850585e-02-1.079451e-02i

[89] 3.758234e-02-1.066307e-02i 3.669020e-02-1.053461e-02i

[91] 3.582801e-02-1.040900e-02i 3.499445e-02-1.028616e-02i

[93] 3.418827e-02-1.016598e-02i 3.340827e-02-1.004839e-02i

[95] 3.265333e-02-9.933293e-03i 3.192239e-02-9.820610e-03i

[97] 3.121444e-02-9.710263e-03i 3.052852e-02-9.602178e-03i

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[103] 2.739924e-02-9.093275e-03i 2.682801e-02-8.997357e-03i

[105] 2.627334e-02-8.903259e-03i 2.573461e-02-8.810926e-03i

[107] 2.521120e-02-8.720308e-03i 2.470255e-02-8.631354e-03i

[109] 2.420810e-02-8.544018e-03i 2.372732e-02-8.458253e-03i

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[115] 2.151188e-02-8.051521e-03i 2.110342e-02-7.974317e-03i

[117] 2.070557e-02-7.898409e-03i 2.031798e-02-7.823763e-03i

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[121] 1.921326e-02-7.607069e-03i 1.886332e-02-7.537152e-03i

[123] 1.852202e-02-7.468343e-03i 1.818908e-02-7.400614e-03i

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[127] 1.723778e-02-7.203649e-03i 1.693569e-02-7.139985e-03i

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[177] 7.886354e-03-4.866910e-03i 7.776219e-03-4.832741e-03i

[179] 7.667958e-03-4.798919e-03i 7.561530e-03-4.765437e-03i

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[189] 6.679826e-03-4.478510e-03i 6.589669e-03-4.448135e-03i

[191] 6.500954e-03-4.418044e-03i 6.413652e-03-4.388231e-03i

[193] 6.327732e-03-4.358693e-03i 6.243167e-03-4.329425e-03i

[195] 6.159928e-03-4.300423e-03i 6.077989e-03-4.271682e-03i

[197] 5.997323e-03-4.243199e-03i 5.917904e-03-4.214969e-03i

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[217] 4.615995e-03-3.721979e-03i 4.556993e-03-3.698088e-03i

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[235] 3.669859e-03-3.318300e-03i 3.623773e-03-3.297380e-03i

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[269] 2.391116e-03-2.678078e-03i 2.361037e-03-2.661170e-03i

[271] 2.331315e-03-2.644357e-03i 2.301944e-03-2.627638e-03i

[273] 2.272919e-03-2.611010e-03i 2.244235e-03-2.594474e-03i

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[293] 1.758148e-03-2.296238e-03i 1.735382e-03-2.281316e-03i

[295] 1.712871e-03-2.266466e-03i 1.690614e-03-2.251686e-03i

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[299] 1.625324e-03-2.207762e-03i 1.604045e-03-2.193256e-03i

[301] 1.583004e-03-2.178817e-03i 1.562196e-03-2.164445e-03i

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[349] 8.028592e-04-1.551522e-03i 7.905653e-04-1.539595e-03i

[351] 7.784056e-04-1.527707e-03i 7.663785e-04-1.515857e-03i

[353] 7.544828e-04-1.504044e-03i 7.427173e-04-1.492268e-03i

[355] 7.310805e-04-1.480530e-03i 7.195713e-04-1.468828e-03i

[357] 7.081884e-04-1.457162e-03i 6.969306e-04-1.445531e-03i

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[365] 6.215297e-04-1.365085e-03i 6.112307e-04-1.353726e-03i

[367] 6.010467e-04-1.342399e-03i 5.909766e-04-1.331105e-03i

[369] 5.810192e-04-1.319842e-03i 5.711736e-04-1.308610e-03i

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[785] 4.615995e-03+3.721979e-03i 4.675844e-03+3.746057e-03i

[787] 4.736555e-03+3.770327e-03i 4.798146e-03+3.794789e-03i

[789] 4.860631e-03+3.819448e-03i 4.924029e-03+3.844306e-03i

[791] 4.988356e-03+3.869366e-03i 5.053631e-03+3.894631e-03i

[793] 5.119871e-03+3.920104e-03i 5.187095e-03+3.945788e-03i

[795] 5.255322e-03+3.971686e-03i 5.324573e-03+3.997802e-03i

[797] 5.394866e-03+4.024139e-03i 5.466222e-03+4.050700e-03i

[799] 5.538662e-03+4.077489e-03i 5.612209e-03+4.104508e-03i

[801] 5.686883e-03+4.131762e-03i 5.762708e-03+4.159255e-03i

[803] 5.839707e-03+4.186989e-03i 5.917904e-03+4.214969e-03i

[805] 5.997323e-03+4.243199e-03i 6.077989e-03+4.271682e-03i

[807] 6.159928e-03+4.300423e-03i 6.243167e-03+4.329425e-03i

[809] 6.327732e-03+4.358693e-03i 6.413652e-03+4.388231e-03i

[811] 6.500954e-03+4.418044e-03i 6.589669e-03+4.448135e-03i

[813] 6.679826e-03+4.478510e-03i 6.771456e-03+4.509173e-03i

[815] 6.864591e-03+4.540129e-03i 6.959264e-03+4.571382e-03i

[817] 7.055507e-03+4.602938e-03i 7.153356e-03+4.634801e-03i

[819] 7.252846e-03+4.666977e-03i 7.354014e-03+4.699472e-03i

[821] 7.456896e-03+4.732290e-03i 7.561530e-03+4.765437e-03i

[823] 7.667958e-03+4.798919e-03i 7.776219e-03+4.832741e-03i

[825] 7.886354e-03+4.866910e-03i 7.998408e-03+4.901431e-03i

[827] 8.112424e-03+4.936311e-03i 8.228448e-03+4.971555e-03i

[829] 8.346527e-03+5.007172e-03i 8.466708e-03+5.043166e-03i

[831] 8.589043e-03+5.079546e-03i 8.713581e-03+5.116317e-03i

[833] 8.840376e-03+5.153487e-03i 8.969482e-03+5.191064e-03i

[835] 9.100954e-03+5.229054e-03i 9.234852e-03+5.267466e-03i

[837] 9.371233e-03+5.306308e-03i 9.510160e-03+5.345586e-03i

[839] 9.651695e-03+5.385311e-03i 9.795904e-03+5.425489e-03i

[841] 9.942854e-03+5.466130e-03i 1.009261e-02+5.507243e-03i

[843] 1.024526e-02+5.548836e-03i 1.040085e-02+5.590920e-03i

[845] 1.055948e-02+5.633503e-03i 1.072122e-02+5.676596e-03i

[847] 1.088616e-02+5.720209e-03i 1.105437e-02+5.764351e-03i

[849] 1.122594e-02+5.809035e-03i 1.140096e-02+5.854269e-03i

[851] 1.157953e-02+5.900067e-03i 1.176175e-02+5.946439e-03i

[853] 1.194770e-02+5.993397e-03i 1.213749e-02+6.040954e-03i

[855] 1.233124e-02+6.089122e-03i 1.252904e-02+6.137914e-03i

[857] 1.273102e-02+6.187342e-03i 1.293728e-02+6.237421e-03i

[859] 1.314796e-02+6.288165e-03i 1.336318e-02+6.339588e-03i

[861] 1.358307e-02+6.391705e-03i 1.380776e-02+6.444532e-03i

[863] 1.403739e-02+6.498083e-03i 1.427212e-02+6.552375e-03i

[865] 1.451209e-02+6.607424e-03i 1.475746e-02+6.663249e-03i

[867] 1.500839e-02+6.719866e-03i 1.526505e-02+6.777295e-03i

[869] 1.552762e-02+6.835552e-03i 1.579628e-02+6.894659e-03i

[871] 1.607121e-02+6.954635e-03i 1.635262e-02+7.015500e-03i

[873] 1.664071e-02+7.077276e-03i 1.693569e-02+7.139985e-03i

[875] 1.723778e-02+7.203649e-03i 1.754721e-02+7.268293e-03i

[877] 1.786423e-02+7.333939e-03i 1.818908e-02+7.400614e-03i

[879] 1.852202e-02+7.468343e-03i 1.886332e-02+7.537152e-03i

[881] 1.921326e-02+7.607069e-03i 1.957215e-02+7.678124e-03i

[883] 1.994028e-02+7.750345e-03i 2.031798e-02+7.823763e-03i

[885] 2.070557e-02+7.898409e-03i 2.110342e-02+7.974317e-03i

[887] 2.151188e-02+8.051521e-03i 2.193133e-02+8.130056e-03i

[889] 2.236217e-02+8.209958e-03i 2.280483e-02+8.291265e-03i

[891] 2.325973e-02+8.374016e-03i 2.372732e-02+8.458253e-03i

[893] 2.420810e-02+8.544018e-03i 2.470255e-02+8.631354e-03i

[895] 2.521120e-02+8.720308e-03i 2.573461e-02+8.810926e-03i

[897] 2.627334e-02+8.903259e-03i 2.682801e-02+8.997357e-03i

[899] 2.739924e-02+9.093275e-03i 2.798771e-02+9.191067e-03i

[901] 2.859412e-02+9.290792e-03i 2.921920e-02+9.392509e-03i

[903] 2.986372e-02+9.496283e-03i 3.052852e-02+9.602178e-03i

[905] 3.121444e-02+9.710263e-03i 3.192239e-02+9.820610e-03i

[907] 3.265333e-02+9.933293e-03i 3.340827e-02+1.004839e-02i

[909] 3.418827e-02+1.016598e-02i 3.499445e-02+1.028616e-02i

[911] 3.582801e-02+1.040900e-02i 3.669020e-02+1.053461e-02i

[913] 3.758234e-02+1.066307e-02i 3.850585e-02+1.079451e-02i

[915] 3.946222e-02+1.092901e-02i 4.045303e-02+1.106670e-02i

[917] 4.147995e-02+1.120769e-02i 4.254478e-02+1.135210e-02i

[919] 4.364941e-02+1.150008e-02i 4.479585e-02+1.165175e-02i

[921] 4.598624e-02+1.180726e-02i 4.722287e-02+1.196676e-02i

[923] 4.850818e-02+1.213042e-02i 4.984476e-02+1.229841e-02i

[925] 5.123539e-02+1.247090e-02i 5.268303e-02+1.264808e-02i

[927] 5.419086e-02+1.283015e-02i 5.576227e-02+1.301733e-02i

[929] 5.740092e-02+1.320984e-02i 5.911070e-02+1.340792e-02i

[931] 6.089582e-02+1.361183e-02i 6.276079e-02+1.382182e-02i

[933] 6.471047e-02+1.403819e-02i 6.675009e-02+1.426125e-02i

[935] 6.888532e-02+1.449130e-02i 7.112225e-02+1.472871e-02i

[937] 7.346748e-02+1.497384e-02i 7.592818e-02+1.522708e-02i

[939] 7.851208e-02+1.548886e-02i 8.122762e-02+1.575963e-02i

[941] 8.408395e-02+1.603987e-02i 8.709105e-02+1.633011e-02i

[943] 9.025979e-02+1.663092e-02i 9.360208e-02+1.694289e-02i

[945] 9.713092e-02+1.726667e-02i 1.008606e-01+1.760299e-02i

[947] 1.048067e-01+1.795260e-02i 1.089866e-01+1.831632e-02i

[949] 1.134192e-01+1.869508e-02i 1.181255e-01+1.908984e-02i

[951] 1.231288e-01+1.950169e-02i 1.284549e-01+1.993178e-02i

[953] 1.341324e-01+2.038142e-02i 1.401934e-01+2.085200e-02i

[955] 1.466737e-01+2.134509e-02i 1.536132e-01+2.186240e-02i

[957] 1.610571e-01+2.240583e-02i 1.690562e-01+2.297749e-02i

[959] 1.776679e-01+2.357973e-02i 1.869574e-01+2.421517e-02i

[961] 1.969990e-01+2.488677e-02i 2.078776e-01+2.559782e-02i

[963] 2.196906e-01+2.635208e-02i 2.325503e-01+2.715380e-02i

[965] 2.465868e-01+2.800783e-02i 2.619514e-01+2.891971e-02i

[967] 2.788213e-01+2.989584e-02i 2.974047e-01+3.094364e-02i

[969] 3.179482e-01+3.207176e-02i 3.407457e-01+3.329033e-02i

[971] 3.661500e-01+3.461137e-02i 3.945879e-01+3.604919e-02i

[973] 4.265804e-01+3.762105e-02i 4.627696e-01+3.934792e-02i

[975] 5.039554e-01+4.125558e-02i 5.511464e-01+4.337616e-02i

[977] 6.056317e-01+4.575028e-02i 6.690843e-01+4.843009e-02i

[979] 7.437147e-01+5.148388e-02i 8.325037e-01+5.500296e-02i

[981] 9.395690e-01+5.911267e-02i 1.070765e+00+6.399028e-02i

[983] 1.234712e+00+6.989583e-02i 1.444657e+00+7.722834e-02i

[985] 1.722110e+00+8.663566e-02i 2.104582e+00+9.924956e-02i

[987] 2.664186e+00+1.172526e-01i 3.560417e+00+1.454908e-01i

[989] 5.232631e+00+1.973590e-01i 9.492832e+00+3.281794e-01i

[991] 5.175265e+01+1.626392e+00i -1.075467e+02-3.041622e+00i

[993] 9.698368e+01+2.437979e+00i -9.976429e+01-2.194285e+00i

[995] 1.047700e+02+1.975103e+00i -5.313556e+01-8.347201e-01i

[997] -1.245892e+01-1.565717e-01i -8.331384e+00-7.852377e-02i

[999] -6.848536e+00-4.303119e-02i -6.217813e+00-1.953390e-02i

>

> plot(x,y\_x,type = "l",col=60,main="Вейвлет Шенона")

>

> #Вейвлет Гауса

> y\_gauss <- function(x) exp(-x\*\*2/2)

> y\_x <- array(n)

>

> for (i in 1:n) {

+ y\_x[i]=y\_gauss(x[i])

+ }

>

> plot(x,y\_x,type = "l",col=60,main="Вейвлет Гауса")

