APPENDIX A

LIST OF PUBLICATIONS

1. Alhawamda H., Taib B.M, *Eshkuvatov Z.K.*, Ibrahim R. I, A New Class of Orthogonal Polynomials for Solving Logarithmic Singular Integral Equations, accepted for publication in International Journal of Scientific and Engineering Research (IJSER) (ISSN 2229-5518), 2018.

2. Alhawamda, H., Taib, B. M., Eshkuvatov, Z. K. and Ibrahim, R. I, Bachok–Hasham Polynomials Approach For Eigenvalues Problem of Logarithmic Singular Integral Equations, proceeding of postgraduate *seminar on science and technology* (KoSiST 16) eISBN:978-967-440-399-7, *2017 pp106-118.*

3. Alhawamda, H., Taib, B. M., Eshkuvatov, Z. K. and Ibrahim, R. I, Bachok-Hasham Polynomials of The Second Kind For Solving A Special Class Of Singular Integral Equations, 25th National Symposium on Mathematical Sciences (SKSM25), 27-29 August 2017. (under review)

4. Alhawamda, H., Taib, B. M., Eshkuvatov, Z. K. and Ibrahim, R. I, Bachok–Hasham Polynomials of the Third and Fourth Kind For Solving A Special Class Of Singular Integral Equations, accepted for publication in International Journal of Pure and Applied MathematicsISSN: 1311-8080, 2017.

APPENDIX B

SOME OF MATLAB CODE

Example 1

$k = 5$

$n = 5$

$a = -1$

$b = 1$

syms x

for $i = 1 : n;$

$c(i) = (int(((-2 * i. * k.^2)/pi.^2)((-pi/5) * x.^5). * (x.^(k-1)). * (1 - x.^(2. * k)).^-0.5). * cos((i). * acos(x.^k)), -1, 1)); end; disp(c)$

syms $xa1 = (int(((k.^2)/((log(2)).^2. * pi.^2))((-pi/5) * x.^5). * (x.^(k-1)). * (1 - x.^(2. * k)).^-0.5). * cos((0). * acos(x.^k)), -1, 1))$

for $j = 1 : ns(j) = (x.^(k-1) * (1 - x.^(2. * k))).^(-0.5). * c(j). * (cos((j). * acos(x.^k)))); ends = sum(s); u = a1 * (x.^(k-1). * (1 - x.^(2. * k)).^(-0.5)) + s$

$f = matlabFunction(u) v = (1/(1)). * x.^(k-1). * (1 - x.^(2 * k)).^(-0.5). * (x.^5)$

$d = matlabFunction(v) fplot(f, [ab], 'g') holdon fplot(d, [ab], 'r') holdoff$

$fore = 1 : 9 z1(e) = d(e/10) - f(e/10) end fore = 1 : 9 z2(e) = d(-e/10) - f(-e/10) end z3 = d(95/100) - f(95/100) z4 = d(-95/100) - f(-95/100)$

Example 2

$k = 3$

$n = 5$

$a = -1$

$b = 1$

syms x

for $i = 1 : n + 1; for j = 1 : n; m(i, j) = vpa(int(-(pi/(j. * k)).(cos((j). * acos(x.^k))) * (cos((i-1). * acos(x.^k))), -1, 1)); end; end; disp(m)$

syms x for $i = 1 : n + 1; c(i) = int(cos((i-1). * acos(x.^k)), -1, 1); end; disp(c) symsx$

$fori=1:n+1;R(i)=vpa(int(((1/3)*(3*x.^5+pi*x.^3*(1-x.^6).^0.5).*((1-x.^6).^-0.5)).*$
$cos((i-1).*acos(x.^k)),-1,1));end;disp(R)p=(-pi/k).*log(2)*cI=vpa((pi/k).*$
$log(2)*eye(1,n+1))$
$H=I-pM=vpa([H'm(:,1:n)])I1=(pi/(2.*k)).*eye(n+1)D=I1-MD(1:1:1)=$
$(pi/k).*(log(2).*c(1)-1)A1=vpa(double(D));B1=vpa(double(R'));y1=vpa(inv(A1)*$
$B1);forj=1:n+1s(j)=(x.^(k-1).*(1-x.^(2.*k)).^(-0.5).*y1(j).*(cos((j-1).*$
$acos(x.^k))));end$ s=sum(s); $f=matlabFunction(s)v=x.^(k-1).*(1-x.^(2*k)).^(-0.5).*$
$(x.^3)$
$d=matlabFunction(v)$ fplot(f,[a b],'g') hold on fplot(d,[a b],'r') hold off

for e=1:9 z1(e)=d(e/10)-f(e/10) end for e=1:9 z2(e)=d(-e/10)-f(-e/10) end

Example 3 case (I)

$k=1$

$n=5$

$a=-1$

$b=1$

syms x

for $i=1:n;$

for$j=1:n;$

$m(i,j)=vpa(int((pi/k).*(sin((j)*acos(x.^k))).*sin(acos(x.^k)).^(-1)).*$
$(x.^(k-1).*(1-x.^(2.*k))^0.5).*(sin((i).*acos(x.^k)).sin(acos(x.^k)).^(-1)),-1,1));$

$end;$

$end;$

$disp(m)$

syms x

for $i=1:n;c(i)=vpa(int((1/k).*(x.^4+5.*x.^3+2.*x.^2+x-(11/8)).*(x.^(k-1).*$
$(1-x.^(2.*k)).^0.5).*sin((i).*acos(x.^k)).*sin(acos(x.^k)).^(-1),-1,1));end;disp(c)$

$A=vpa(double(m));B=vpa(double(c'));y=vpa(inv(A)*B)$

$forj=1:5s(j)=((1-x.^2).^(-0.5).*y(j).*(cos((j).*acos(x.^k))));end$

$s=sum(s);$

$c=sf=matlabFunction(c)v=(1/pi).*(1-x.^(2*k)).^(-0.5).*(x.^5+5*x.^4+(3/2).*$
$x.^3-(3/2).*x.^2-(5/2).*x-(9/8))d=matlabFunction(v)$

$fplot(f,[ab],'g')$

$holdonfplot(d,[ab],'r')$

$holdoffforе=1:9$

$z1(e)=d(e/10)-f(e/10)$

$endfore=1:9$

$z2(e) = d(-e/10) - f(-e/10)$

end

$z3 = d(95/100) - f(95/100) z4 = d(-95/100) - f(-95/100)$

Example 3 case (II)

$k = 1$

$n = 5$

$a = -1$

$b = 1$

syms x for $i = 1 : n$;

for $j = 1 : n$;

$m(i, j) = vpa(int((pi/k).*(cos((j).*acos(x.^k))).*(x.^(k-1).*(1-x.^2).^-0.5).*(cos((i).*acos(x^k))), -1, 1))$; *end*; end; disp(m) syms x for $i = 1 : n$;

$c(i) = vpa(int((-1/k).*(x.^4+5.*x.^3+2.*x.^2+x-(11/8)).*((1-x.^2).^-0.5).*(cos((i).*acos(x))), -1, 1))$; *end*;

disp(c) A=vpa(double(m));

B=vpa(double(c'));

y=vpa(inv(A)*B)

for $j = 1 : n\ s(j) = vpa((1-x.^2).^0.5).*y(j).*(sin((j).*acos(x.^k)).*sin(acos(x.^k)).^(-1)))$; end s=sum(s); f = matlabFunction(s) $v = (-1/pi).*(1-x.^2).^0.5).*(x.^3)+(5).*x.^2+(5/2).*x+(7/2))$d = matlabFunction(v)

fplot(f,[a b],'g') hold on fplot(d,[a b],'r') hold off for e=1:9 z1(e)=d(e/10)-f(e/10) end for e=1:9 z2(e)=d(-e/10)-f(-e/10) end m1=d(95/100)-f(95/100) m2=d(-95/100)-f(-95/100)

Example 3 case (III)

$k = 1\ a = -1\ b = 1$ syms $x\ b0 = @(x)(x.^(k-1).*((1-x.^(k)).^0.5).((1+x.^(k)).^-0.5).*(sin(0.5.*acos(x.^k))).^(-1).*(sin((1-1+0.5).*acos(x.^k)))).*(x.^4+5*x.^3+2*x.^2+x-(11/8))$;

$b1 = @(x)(x.^(k-1).*((1-x.^(k)).^0.5).*((1+x.^(k)).^-0.5)*(sin(0.5.*acos(x.^k))).^(-1).*(sin((2-1+0.5).*acos(x.^k)))).*(x.^4+5*x.^3+2*x.^2+x-(11/8))$;

$b2 = @(x)(x.^(k-1).*((1-x.^(k)).^0.5).*((1+x.^(k)).^-0.5).*(sin(0.5.*acos(x.^k))).^(-1).*(sin((3-1+0.5).*acos(x.^k)))).*(x.^4+5*x.^3+2*x.^2+x-(11/8))$;

$b3 = @(x)(x.^(k-1).*((1-x.^(k)).^0.5).*((1+x.^(k)).^-0.5).*(sin(0.5.*acos(x.^k))).^(-1).*(sin((4-1+0.5).*acos(x.^k)))).*(x.^4+5*x.^3+2*x.^2+x-(11/8))$; $b4 = @(x)(x.^(k-1).*((1-x.^(k)).^0.5).*((1+x.^(k)).^-0.5).*(sin(0.5.*acos(x.^k))).^(-1).*(sin((5-1+0.5).*acos(x.^k)))).*(x.^4+5*x.^3+2*x.^2+x-(11/8))$; $b5 = @(x)(x.^(k-1).*((1-x.^(k)).^0.5).*((1+x^(k)).^-0.5).*(sin(0.5.*acos(x.^k))).^(-1).*(sin((6-1+0.5)*acos(x.^k)))).*(x.^4+5*x.^3+2*x.^2+x-(11/8))$;

$a0 = vpa((k.^2/pi.^2).*integral(b0,-1,1))a1 = vpa((k.^2/pi.^2).*integral(b1,-1,1))$
$a2 = vpa((k.^2/pi.^2).*integral(b2,-1,1))a3 = vpa((k.^2/pi.^2).*integral(b3,-1,1))a4 =$
$vpa((k.^2/pi.^2).*integral(b4,-1,1))a5 = vpa((k.^2/pi.^2).*integral(b5,-1,1))$
s= $a0.*((x.^{k}-1).*(1-x.^{k}).^{-0.5}).*(1+x.^{k}).^{0.5}).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((0+0.5).*acos(x.^{k})))+a1.*((x.^{k}-1).*(1-x.^{k}).^{-0.5}).*(1+x.^{k}).^{0.5}).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((1+0.5).*acos(x.^{k})))+a2.*((x.^{k}-1).*(1-x.^{k}).^{-0.5}).*(1+x.^{k}).^{0.5}).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((2+0.5).*acos(x.^{k})))+a3.*((x.^{k}-1).*(1-x.^{k}).^{-0.5}).*(1+x.^{k}).^{0.5}).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((3+0.5).*acos(x.^{k})))+a4.*((x.^{k}-1).*(1-x.^{k}).^{-0.5}).*(1+x.^{k}).^{0.5}).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((4+0.5).*acos(x.^{k})))+a5.*((x.^{k}-1).*(1-x.^{k}).^{-0.5}).*(1+x.^{k}).^{0.5}).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((5+0.5).*acos(x.^{k})))$
f = matlabFunction(s) $v=(1/pi).*x.^{k}-1).*(1+x.^{k}).^{0}.5.*((1-x.^{k}).^{-}0.5).*(x.^{4}+4*x.^{3}-(5/2).*x.^{2}+x-(7/2))d = matlabFunction(v)$

fplot(f,[a b],'g') hold on fplot(d,[a b],'r') hold off for e=1:9 z1(e)=d(e/10)-f(e/10) end for e=1:9 z2(e)=d(-e/10)-f(-e/10) end z3=d(95/100)-f(95/100) z4=d(-95/100)-f(-95/100)

Example 3 case (iv)

$k = 1$

$a = -1$

$b = 1$

syms x

$b0 = @(x)(x.^{k}-1).*((1+x.^{k}).^{0}.5).*((1-x.^{k}).^{-}0.5).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((1-1+0.5).*acos(x.^{k}))).*(x.^{4}+5*x.^{3}+2*x.^{2}+x-(11/8));$

$b1 = @(x)(x.^{k}-1).*((1+x.^{k}).^{0}.5).*((1-x.^{k}).^{-}0.5).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((2-1+0.5).*acos(x.^{k}))).*(x.^{4}+5*x.^{3}+2*x.^{2}+x-(11/8));$

$b2 = @(x)(x.^{k}-1).*((1+x.^{k}).^{0}.5).*((1-x.^{k}).^{-}0.5).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((3-1+0.5).*acos(x.^{k}))).*(x.^{4}+5*x.^{3}+2*x.^{2}+x-(11/8));$

$b3 = @(x)(x.^{k}-1).*((1+x.^{k}).^{0}.5).*((1-x.^{k}).^{-}0.5).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((4-1+0.5).*acos(x.^{k}))).*(x.^{4}+5*x.^{3}+2*x.^{2}+x-(11/8));$

$b4 = @(x)(x.^{k}-1).*((1+x.^{k}).^{0}.5).*((1-x.^{k}).^{-}0.5).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((5-1+0.5).*acos(x.^{k}))).*(x.^{4}+5*x.^{3}+2*x.^{2}+x-(11/8));$

$b5 = @(x)(x.^{k}-1).*((1+x.^{k}).^{0}.5).*((1-x.^{k}).^{-}0.5).*(cos(0.5.*acos(x.^{k}))).^{-1}).*(cos((6-1+0.5).*acos(x.^{k}))).*(x.^{4}+5*x.^{3}+2*x.^{2}+x-(11/8));$

$a0 = -vpa((k.^2/pi.^2).*integral(b0,-1,1))a1 = -vpa((k.^2/pi.^2).*integral(b1,-1,1))a2 =$
$-vpa((k.^2/pi.^2).*integral(b2,-1,1))a3 = -vpa((k.^2/pi.^2).*integral(b3,-1,1))a4 =$
$-vpa((k.^2/pi.^2).*integral(b4,-1,1))a5 = -vpa((k.^2/pi.^2).*integral(b5,-1,1))$

s= $a0.*((x.^{k}-1).*(1+x.^{k}).^{-0.5}).*(1-x.^{k}).^{0.5}).*(sin(0.5.*acos(x.^{k}))).^{-}$

$1)).*(sin((0+0.5).*acos(x.^k)))) + a1.*((x.^(k-1).*(1+x.^k).^(-0.5).*(1-x.^k).^(0.5).*(sin(0.5.*acos(x.^k))).^(-1)).*(sin((1+0.5).*acos(x.^k)))) + a2.*((x.^(k-1).*(1+x.^k).^(-0.5).*(1-x.^k).^(0.5).*(sin(0.5.*acos(x.^k))).^(-1)).*(sin((2+0.5).*acos(x.^k)))) + a3.*((x.^(k-1).*(1+x.^k).^(-0.5).*(1-x.^k).^(0.5).*(sin(0.5.*acos(x.^k))).^(-1)).*(sin((3+0.5).*acos(x.^k)))) + a4.*((x.^(k-1).*(1+x.^k).^(-0.5).*(1-x.^k).^(0.5).*(sin(0.5.*acos(x.^k))).^(-1)).*(sin((4+0.5).*acos(x.^k)))) + a5.*((x.^(k-1).*(1+x.^k).^(-0.5).*(1-x.^k).^(0.5).*(sin(0.5.*acos(x.^k))).^(-1)).*(sin((5+0.5).*acos(x.^k))))$
f = matlabFunction(s) $v=(-1/pi).*x.^(k-1).*(1-x.^k).^0.5.*((1+x.^k).^(-0.5)).*(x.^4+6.*x.^3+(15/2).*x.^2+6.*x+(7/2))d = matlabFunction(v)$

fplot(f,[a b],'g') hold on fplot(d,[a b],'r') hold off for e=1:9 z1(e)=d(e/10)-f(e/10) end for e=1:9 z2(e)=d(-e/10)-f(-e/10) end z3=d(95/100)-f(95/100) z4=d(-95/100)-f(-95/100)
Example 4 case (ii)

$k = 3$

$n = 5$

$a = -1$

$b = 1$

syms x

for $i = 1 : n;$

for $j = 1 : n;$

$m(i,j) = vpa(int((pi.^2/k.^2).*(cos((j).*acos(x.^k))).*(x.^(k-1)).*(1-x.^(2.*k)).^-0.5).*(cos((i).*acos(x.^k))),-1,1));end;end;$ disp(m) $symsx for i = 1:n; c(i) = vpa(int((pi/k).*(cos((4).*acos(x.^k))).*(x.^(k-1).*(1-x.^(2.*k)).^-0.5).*(cos((i).*acos(x.^k))),-1,1))end;$

$disp(c)\ A = vpa(double(m)); B = vpa(double(c')); s = vpa(inv(A)*B)$

$for j = 1 : n\ s(j) = (x.^2.*(1-x.^6).^(0.5)).*y(j).*(sin((j).*acos(x.^k)).*sin(acos(x.^k)).^(-1)));end\ s = sum(s);$

$f = matlabFunction(s) v = (3/(pi)).*x.^2.*(1-x.^6).^(0.5).*(8*x.^9-4*x.^3)$

$d = matlabFunction(v) fplot(f,[ab],'-k') holdonfplot(d,[ab],'k') holdoff$

$fore = 1 : 9 z1(e) = d(e/10) - f(e/10) end fore = 1 : 9 z2(e) = d(-e/10) - f(-e/10) end$

$f =$ matlabFunction(s)

$v = 3\ pix^2(1-x^6)^(0.5)(8x^9-4x^3)$

$d =$ matlabFunction(v)

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