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APPENDIX

PROGRAM COMPUTER TO CALCULATED MAGNITUDE AND DEFLECTION ANGLE

OF WAVE-INDUCED SURFACE DRIFT AND VERTICAL VELOCITY PROFILE

```
1 REM "THE CURRENT INDUCED BY WAVE"
2 REM "WATER DEPTH":"NU=THE KINETIC OF VISCOSITY":"UA=THE SHEAR STRESS":"K=WAVE  NUMBER":"C=WAV
E SPEED":"T=WAVE PERIOD":"L=WAVE LEN
GTH":"OM=WAVE FREQUENCY"
3 REM "XI=EKMAN DEPTH":"L=WAVE LENGTH":"OME=THE FREQUENCY OF EARTH":"V0=THE VELO  CITY NEAR THE
BOTTOM IN Y DIRECTION"
10 I=0
15 G=1.95#3.3333333338
20 T=4
30 A=1.2694
40 OM=2#3.14159278/T
50 OME=.0000729
60 UA=.09161#.05643
70 V0=0
80 DEF FNSINH(G)=(EXP(G)-EXP(-G))/2
90 DEF FNCOSH(G)=(EXP(G)+EXP(-G))/2
100 DEF FNCOTH(G)=(EXP(G)+EXP(-G))/(EXP(G)-EXP(-G))
110 DEF FNTANH(G)=(EXP(G)-EXP(-G))/(EXP(G)+EXP(-G))
120 PRINT"THE MAGNITUDE AND DEFLECTION ANGLE OF THE WAVE INDUCED SURFACE DRIFT  OR THE VERTICAL
VELOCITY DISTRIBUTION"
130 PRINT"TYPE M OR V:"
140 INPUT"CHOOSE M OR V:",A$:IF A$="M" GOTO 161
150 IF A$="V" THEN GOTO 300
161 FOR KH=.5 TO 22 STEP .5
162 GOSUB 10000
163 K=2#3.14159278/L
164 LPRINT" K#H          K#XI          W/(OM#K#A^2)     THETA            H            L"
170 H=KH#L/2/3.14159278
175 PRINT "T=";T,"H=";H,"L=";L
180 FOR KDEL=.5 TO 5 STEP .5
190 XI=KDEL#L/2/3.14159278
200 NU=XI^2#OME
210 GOSUB 1000
220 PRINT K#H,K#XI,W/(OM#K#A^2),THETA,H,L
230 LPRINT K#H,K#XI,W/(OM#K#A^2),THETA,H,L
240 NEXT KDEL
250 NEXT KH
260 END
300 FOR R=1 TO 5
```

```
305 READ HL,IN
306 LPRINT:LPRINT "H/L=";HL
310 L=9.81*T*T*FNTANH(2*3.14159273*HL)/2/3.14159273
315 PRINT L
320 H=HL*L
340 K=2*3.14159273/L
350 FOR KDEL=.25 TO 2 STEP .25
355 LPRINT:LPRINT "KDEL=";KDEL
360 XI=KDEL*L/2/3.14159273
370 NU=XI*XI*OME
375 LPRINT "    Z/L   U/(OM*K*A^2) V/(OM*K*A^2) WW/(OM*K*A^2) THETA  OM*K*A^2 U   V   W"
500 FOR Z=0 TO -KDEL*L STEP -(KDEL*L/40)
510 GOSUB 1000
520 LPRINT USING "####.#####";Z/L,U/(OM*K*A^2),V/(OM*K*A^2),WW/(OM*K*A^2);THETA,OM*K*A^2,U,V,W
530 NEXT Z
535 NEXT KDEL
537 NEXT R
540 RETURN
600 DATA 1.5,2,1,1,.5,1,.25,.5,.125,.25
1000 U11=(COS((Z+H)/XI)*FNSINH((Z+H)/XI)+SIN((Z+H)/XI)*FNCOSH((Z+H)/XI))*COS(H/XI)*FNCOSH(H/XI)+
(SIN((Z+H)/XI)*FNCOSH((Z+H)/XI)-COS(
(Z+H)/XI)*FNSINH((Z+H)/XI))*SIN(H/XI)*FNSINH(H/XI)
1010 U12=(COS(H/XI))^2*(FNCOSH(H/XI))^2+(SIN(H/XI))^2*(FNSINH(H/XI))^2
1020 U1=XI*UA^2*U11/2/NU/U12
1030 U2=OM*K*A^2*FNCOSH(2*K*(Z+H))/2/(1+1/(4*K^4*XI^4))/(FNSINH(K*H))^2
1040 U31=2*COS(Z/XI)*FNCOSH(Z/XI)*(5*OM*K*A^2/4/(FNSINH(K*H))^2-OM*K*A^2/2/(1+1/(4*K^4*XI^4))/(F
NSINH(K*H))^2)-2*SIN(Z/XI)*FNSINH(Z/ XI)*(VO-OM*A^2/4/K/XI^2/(1+1/(4*K^4*XI^4))/(FNSINH(K*H))^2)
1050 U32=XI*COS((Z+H)/XI)*FNSINH((Z+H)/XI)*(4*OM*K^2*A^2*FNCOTH(K*H)-OM*A^2*FNSINH(2*K*H)*(2*K^2
+1/XI^2)/2/(1+1/(4*K^4*XI^4))/(FNSIN H(K*H))^2)
1060 U33=XI*SIN((Z+H)/XI)*FNCOSH((Z+H)/XI)*(4*OM*K^2*A^2*FNCOTH(K*H)-OM*A^2*FNSINH(2*K*H)*(2*K^2
-1/XI^2)/2/(1+1/(4*K^4*XI^4))/(FNSIN H(K*H))^2)
1070 U34=2*SIN(Z/XI)*FNSINH(Z/XI)*(5*OM*K*A^2/4/(FNSINH(K*H))^2-OM*K*A^2/2/(1+1/(4*K^4*XI^4))/(F
NSINH(K*H))^2)+2*COS(Z/XI)*FNCOSH(Z/
XI)*(VO-OM*A^2/K/XI^2/4/(1+1/(4*K^4*XI^4))/(FNSINH(K*H))^2)
1080 U35=XI*SIN((Z+H)/XI)*FNCOSH((Z+H)/XI)*(4*OM*K^2*A^2*FNCOTH(K*H)-OM*A^2*FNSINH(2*K*H)*(2*K^2
+1/XI^2)/2/(1+1/(4*K^4*XI^4))/(FNSIN H(K*H))^2)
1090 U36=XI*COS((Z+H)/XI)*FNSINH((Z+H)/XI)*(4*OM*K^2*A^2*FNCOTH(K*H)-OM*A^2*FNSINH(2*K*H)*(2*K^2
-1/XI^2)/2/(1+1/(4*K^4*XI^4))/(FNSIN H(K*H))^2)
1100 U3=(COS(H/XI)*FNCOSH(H/XI)*(U31+U32+U33)+SIN(H/XI)*FNSINH(H/XI)*(U34+U35-U36))/(2*U12)
1110 U=U2+U3
1120 V11=(SIN((Z+H)/XI)*FNCOSH((Z+H)/XI)-COS((Z+H)/XI)*FNSINH((Z+H)/XI))*COS(H/XI)*FNCOSH(H/XI)-
(COS((Z+H)/XI)*FNSINH((Z+H)/XI)+SIN(
(Z+H)/XI)*FNCOSH((Z+H)/XI))*SIN(H/XI)*FNSINH(H/XI)
```

```
1130 V1=XI*UA^2*V11/2/HU/U12
1140 V2=OM*A^2*FNCOSH(2*K*(Z+H))/K/XI^2/4/(1+1/(4*K^4*XI^4))/(FNSINH(K*H))^2
1150 V31=2*SIN(Z/XI)*FNSINH(Z/XI)*(5*OM*K*A^2/4/(FNSINH(K*H))^2-OM*K*A^2/2/(1+1/(4*K^4*XI^4))/(F
NSINH(K*H))^2)+2*COS(Z/XI)*FNCOSH(Z/
XI)*(V0-OM*A^2/K/XI^2/4/(1+1/(4*K^4*XI^4))/(FNSINH(K*H))^2)
1160 V32=XI*SIN((Z+H)/XI)*FNCOSH((Z+H)/XI)*(4*OM*K^2*A^2*FNCOTH(K*H)-OM*A^2*FNSINH(2*K*H)*(2*K^2
+1/XI^2)/2/(1+1/(4*K^4*XI^4))/(FNSIN H(K*H))^2)
1170 V33=XI*COS((Z+H)/XI)*FNSINH((Z+H)/XI)*(4*OM*K^2*A^2*FNCOTH(K*H)-OM*A^2*FNSINH(2*K*H)*(2*K^2
-1/XI^2)/2/(1+1/(4*K^4*XI^4))/(FNSIN H(K*H))^2)
1180 V34=2*COS(Z/XI)*FNCOSH(Z/XI)*(5*OM*K*A^2/4/(FNSINH(K*H))^2-OM*K*A^2/2/(1+1/(4*K^4*XI^4))/(F
NSINH(K*H))^2)-2*SIN(Z/XI)*FNSINH(Z/XI)*(V0-OM*A^2/K/XI^2/4/(1+1/(4*K^4*XI^4))/(FNSINH(K*H))^2)
1190 V35=XI*COS((Z+H)/XI)*FNSINH((Z+H)/XI)*(4*OM*K^2*A^2*FNCOTH(K*H)-OM*A^2*FNSINH(2*K*H)*(2*K^2
+1/XI^2)/2/(1+1/(4*K^4*XI^4))/(FNSIN H(K*H))^2)
1200 V36=XI*SIN((Z+H)/XI)*FNCOSH((Z+H)/XI)*(4*OM*K^2*A^2*FNCOTH(K*H)-OM*A^2*FNSINH(2*K*H)*(2*K^2
-1/XI^2)/2/(1+1/(4*K^4*XI^4))/(FNSIN
H(K*H))^2)
1210 V3=(COS(H/XI)*FNCOSH(H/XI)*(V31+V32-V33)-SIN(H/XI)*FNSINH(H/XI)*(V34+V35+V36))/2/U12
1220 V=V2+V3
1230 WW=SQR(U^2+V^2)
1240 THETA=180/3.14159278*ATN(V/U)
1250 RETURN
10000 REM PROGRAM FOR CALCULATING WAVELENGTH FROM GIVEN PERIOD AND WATER DEPTH
10030 G=9.81
10040 L=G*T*T/2/3.14159278
10050 FOR N=1 TO 100
10060 LL=L
10070 L=G*T*T/2/3.14159278*FNTANH(KH/L)
10080 IF ABS(LL-L)<.0000001 GOTO 10110
10110 NEXT N
10900 RETURN
```

VITA

Name	Mr. Soopphaporn Pukasemvarangkool
Born	August 24, 2499 (1956), in Suratthani, Thailand
Education	B.Sc. in Physics, March 13, 1982
	Kasetsart University
	Bangkok, Thailand