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% corrections made:
%     added line 13 Tu2= Tu*Tu
%     added line 17 Te2= Te*Te
%     line 46 make operator a division
%     line 74 changed HE to sqrt(HE)

yr = [1972  1994]
mo = [6  4]
day= [23 8]
hr = [0 21]
min= [17 54]
sec= [52 9]

Tu = (367*yr-fix(7*(yr+fix((mo+9)/12))/4)+fix(275*mo/9)...
      +day+(hr+(min+(sec/60))/60)/24-730531.5)/36525
Tu2= Tu.*Tu;
Te = Tu+((63+60*Tu)/3200000000)
Te2= Te.*Te;
V = 50+(58517*Te)
E = 357.52558+(35999.04974*Te)
M = 20+(19140*Te)
J = 19.9+(3034.6*Te)
N = 125.0-(1934.1*Te)
L = 200.9+(72001.7*Te)

EL = E+(1018585.1+(6191.2*Te)+(1.1*Te2)...
      +6892.8*sind(E-0.0018)...
      +72.0.*sind(2.*E)...
      -17.4.*Te.*sind(E)...
      +7.2*sind(E-J-90.5)...
      +6.5*sind((445267.1*Te)-62.1)...
      -6.4*sind((20.2*Te)+71.4)...
      +5.5*sind((2*E)-(2*V)-58)...
      -4.8*sind(E-V-29)...
      -2.7*sind((2*E)-(2*J)-3)...
      -2.6*sind(J+7)...
      -2.5*sind((3*E)-(2*V)-46)...
      +2.0*sind((2*E)-(2*M)+74)...
      -1.9*sind((150*Te)+28)...
      +1.8*sind(E-(2*M)-70)...
      -1.6*sind(E-(2*J)+20)...
      -1.6*sind((4*E)-(3*V)-75)...
      +1.0*sind(3*E)...
      -1.0*sind((5*E)-(3*V)-48)...
      -20.5...
      -17.2*sind(N)...

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-1.3*sind(L))./3600

% EL -9268.363115
% -9268.363115075590

Ob = 23.43929-(0.01300*Te)+(0.00256*cosd(N))+(0.00016*cosd(L))
RA = atand(tand(EL).*cosd(Ob))
%if 90<EL<270, then RA = 180+RA
RA(EL>90 & EL<270)= RA(EL>90 & EL<270)+180
RA= mod(RA,180)

Dec = asind(sind(EL).*sind(Ob))
ARIES = 360*(0.7790573+(36625.0021390*Tu)+(0.0000011*Tu2)...
        -(0.0000122*sind(N))-(0.0000009*sind(L)))
ARIES= mod(ARIES,360)
GHA = ARIES-RA
SD = asind(0.004659./(1-0.0167*cosd(E)))
%
% test values
IC= [10.2 -5.8]
HE= [3.4 2.2]
Hs= [50.02000000 2.53000000]
Pres= [1010 1030]
Temp= [22 40]
Long= [172 -58]
Lat= [ -16.1 13]

D = 0.0293*sqrt(HE) % NOTE CORRECTION FROM 0.0293*HE
Ha = Hs+(IC/60)-D
Rc = (0.28.*Pres./(Temp+273)).*0.0167./tand(Ha+(7.31./(Ha+4.4)))
PA = 0.0024*cosd(Ha)
LHA = GHA+Long
Hc= asind((cosd(LHA).*cosd(Lat).*cosd(Dec))+(sind(Lat).*sind(Dec)))
Zc = acosd((sind(Dec)-(sind(Lat).*sind(Hc)))./(cosd(Lat).*cosd(Hc)))
%if 0°<LHA<180°, Zn = 360-Zc
Zn= Zc;
Zn(LHA>=0 & LHA<180)= 360-Zn(LHA>=0 & LHA<180)

p1= 60*(Ha-Rc+PA+SD-Hc); % +SD for lower limb, -SD for upper limb
p2= 60*(Ha-Rc+PA-SD-Hc);
p= [p1(1) p2(2)] % lower limb for 1st case, upper for second case
% Test Problems
%
% yr 1972 1994
% mo 6 4
% day 23 8
% hr 0 21

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```
% min 17 54
% sec 52 9
% Tu -0.275249489 -0.057319299
% Te -0.275249475 -0.05731928
% V -16056.77351 -3304.15233
% E -9551.193949 -1705.914046
% M -5248.274945 -1077.091027
% J -815.3720558 -154.0410883
% N 657.3600089 235.8612202
% L -19617.5301 -3926.18563
% EL -9268.363115 -1421.172693
% Ob 23.44388492 23.43873142
% RA -88.21592359 17.37102545
% RA 91.78407641 17.37102545
% Dec 23.43374638 7.375208356
% ARIES -3628884.262 -755474.5373
% ARIES 275.7376754 165.4626822
% GHA 183.953599 148.0916567
% SD 0.262639337 0.266624737
% HE 3.4 2.2
% D 0.054026531 0.043458923
% Hs 50.02000000 2.53000000
% IC 10.2 -5.8
% Ha 50.13597347 2.38987441
% Pres 1010 1030
% Temp 22 40
% Rc 0.013305383 0.254021969
% PA 0.001538323 0.002397913
% Long 172 -58
% LHA 355.953599 90.0916567
% Lat -16.1 13
% Hc 50.2688665 1.566109477
% Zc 5.813557565 82.79151131
% Zn 5.813557565 277.2084887
% Limb lower upper
% p 7.078755034 18.33096838
```

yr =

1972 1994

mo =

6 4

day =

23 8

hr =

0 21

min =

17 54

sec =

52 9

Tu =

-0.275249489188025 -0.057319298996122

Te =

-0.275249474661453 -0.057319280383358

V =

1.0e+04 *

-1.605677350876423 -0.330415233019298

E =

1.0e+03 *

-9.551193949246505 -1.705914045581526

M =

1.0e+03 *

-5.248274945020204 -1.077091026537480

J =

1.0e+02 *

-8.153720558076444 -1.540410882513394

N =

1.0e+02 *

6.573600089427156 2.358612201894535

L =

1.0e+04 *

-1.961753009973151 -0.392618563037846

EL =

1.0e+03 *

-9.268363115075591 -1.421172692612046

Ob =

23.443884916608862 23.438731415556923

RA =

-88.215923589463287 17.371025448550864

RA =

-88.215923589463287 17.371025448550864

RA =

91.784076410536713 17.371025448550864

Dec =

23.433746383346794 7.375208355683764

ARIES =

1.0e+06 *

-3.628884262324563 -0.755474537317848

ARIES =

1.0e+02 *

2.757376754372381 1.654626821518177

GHA =

1.0e+02 *

1.839535990267013 1.480916567032669

SD =

0.262639336879648 0.266624737036958

IC =

10.199999999999999 -5.800000000000000

HE =

3.400000000000000 2.200000000000000

Hs =

50.020000000000003 2.530000000000000

Pres =

1010 1030

Temp =

22 40

Long =

172 -58

Lat =

-16.100000000000001 13.000000000000000

D =

0.054026530519736 0.043458923134381

Ha =

50.135973469480270 2.389874410198952

Rc =

0.013305383359783 0.254021969147463

PA =

0.001538322807171 0.002397912515920

LHA =

1.0e+02 *

3.559535990267014 0.900916567032669

Hc =

50.268866495233311 1.566109476722800

Zc =

5.813557565464957 82.791511311900578

Zn =

1.0e+02 *

0.058135575654650 2.772084886880994

p =

7.078755034439723 18.330968388459041