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      PROGRAM FALLDISTANCE
*
*  Incrementally determine distance large particle falls
*  throught a fluid to see where it reaches terminal velocity
*
*  Improved by combining with better programming in Collapse
*
*  This program subsequently improved to FALLING in 2002 but this version
*  retained since it was used for Monograph and has more printout
*
      DIMENSION A(7),B(7)
      DOUBLEPRECISION FALL,ACCLRN,TIME
      OPEN(6,FILE='TERMVEL.OUT',STATUS='OLD')
      TIMELAST=0.0
      FALLLAST=0.0
      A(1)=25.9183
      B(1)=-0.8970
      A(2)=24.9985
      B(2)=-0.7572
      A(3)=19.1082
      B(3)=-0.6269
      A(4)= 7.8208
      B(4)=-0.4314
      A(5)= 1.3586
      B(5)=-0.1586
      A(6)= 0.0818
      B(6)= 0.1753
      A(7)= 0.1343
      B(7)= 0.1298
      WRITE(*,*)'Input Diameter in mm'
      READ(*,*) DIAMMM
      DIAM=DIAMMM/1000
      IF(DIAMMM.LT.1.)FACTOR=3294.*(DIAMMM**(-0.6765))
      IF(DIAMMM.GE.1.)FACTOR=4081.*(DIAMMM**0.4671)
      DELVEL=DIAM/FACTOR
 2000 FORMAT(10X,'Diameter in metres and mm    ',2F15.10)
      WRITE(6,2000)DIAM, DIAMMM
      WRITE(6,*)
      RHO=1000.0
      G=9.81
      AREA=3.1416*DIAM**2/4.0
      WPRIME=8475.0*DIAM**3
        DO 100 N=1,2000000
        VEL=N*DELVEL
        RE=762800.0*VEL*DIAM
        IF(RE.LT.0.6) GOTO 400
        IF((RE.GE.0.6).AND.(RE.LT.1.0)) M=1
        IF((RE.GE.1.0).AND.(RE.LT.10.0)) M=2
        IF((RE.GE.10.0).AND.(RE.LT.100.0)) M=3
        IF((RE.GE.100.0).AND.(RE.LT.600.0)) M=4
        IF((RE.GE.600.0).AND.(RE.LT.2500.0)) M=5
        IF((RE.GE.2500.0).AND.(RE.LT.7000.0)) GOTO 410
        IF((RE.GE.7000.0).AND.(RE.LT.40000.0)) M=6
        IF((RE.GE.40000.0).AND.(RE.LT.100000.0)) M=7
        CD=A(M)*RE**B(M)
        IF((RE.GE.100000.0).AND.(RE.LT.200000.0)) GOTO 420
        IF((RE.GE.200000.0).AND.(RE.LT.260000.0)) GOTO 430
        IF(RE.GT.260000.0) GOTO 111
        GOTO 444
  400   CD=24.0/RE
        GOTO 444
  410   CD=0.39
        GOTO 444
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  420   CD= 3.36-0.2385*LOG(RE)
        GOTO 444
  430   CD=11.04-0.8677*LOG(RE)
        GOTO 444
 1000   FORMAT(1X,I10,2X,E10.4,2(2X,F7.3),2E10.3,F12.6,2E13.5)
  444   FD=CD*RHO*AREA*VEL*VEL/2.0
        ACCLRN=(WPRIME-FD)*G/WPRIME
        PWPPRCNT=(G-ACCLRN)*100/G
        TIME=DELVEL/ACCLRN
        FALL=TIME*(VEL-(DELVEL/2.))
        TOTTIME=TIME+TIMELAST
        TOTFALL=FALL+FALLLAST
        RATIOFD=TOTFALL/DIAM
        TIMELAST=TOTTIME
        FALLLAST=TOTFALL
        IF((PWPPRCNT.GT.24.99).AND.(PWPPRCNT.LT.25.01)) GOTO 333
        IF((PWPPRCNT.GT.49.99).AND.(PWPPRCNT.LT.50.01)) GOTO 333
        IF((PWPPRCNT.GT.74.99).AND.(PWPPRCNT.LT.75.01)) GOTO 333
        IF(PWPPRCNT.GE.99.99) GOTO 333
        GOTO 100
  333   WRITE(6,1000)N,VEL,ACCLRN,PWPPRCNT,TOTTIME,TOTFALL,RATIOFD,CD,RE
        IF(FD.GT.WPRIME)GOTO 222
  100 CONTINUE
      GOTO 999
  111 WRITE(6,*)'Reynolds Number out of range'
      WRITE(*,*)'Reynolds Number out of range'
      GOTO 999
  222 WRITE(6,4000)VEL
 4000 FORMAT('Now at Terminal Velocity  ',F15.10)
      WRITE(*,*)'Now at Terminal Velocity'
      HYDCONCM=100.*(DIAMMM/10)**2
      HYDCONM=HYDCONCM/100.
      VTOVERK=VEL/HYDCONM
 5000 FORMAT('Hydraulic Conductivity m/s',F15.10)
      WRITE(6,5000) HYDCONM
 5001 FORMAT('Ratio of Vt over k:       ',F15.10)
      WRITE(6,5001) VTOVERK
  999 STOP
      END
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