```
      PROGRAM DYN_RESPONSE
C THIS PROGRAM WILL CALCULATE THE DYNAMIC COMPRESSOR BLADE RESPONSE BASED
C ON EITHER A FIRST ORDER RESPONSE, SECOND ORDER RESPONSE, OR THE BLADE
C FREQUENCY RESPONSE FUNCTION OBTAINED FROM EXPERIMENTAL DATA FOR THE
C OPERATING REGION.

      integer nmax
      real*8 pi

      parameter (nmax = 8192)
      parameter (pi = 3.14159265358979323846d0)
      integer n

      real a(0 : nmax)
      real b(0:nmax), PT(0:NMAX)
      REAL T(0:NMAX), AOA(0:NMAX)
      REAL PTREL(0:NMAX), u, utip, rho, pamb
      COMPLEX  HH(0:NMAX), AA(0:NMAX), BB(0:NMAX), CC(0:NMAX)
      REAL MAG(0:NMAX), PHASE(0:NMAX), RE(0:NMAX), IM(0:NMAX)
      REAL MAGR(0:NMAX), PHASER(0:NMAX), C(0:NMAX), H(0:NMAX)
C THE INVERSE DISCRETE FOURIER TRANSFORM SEEMS TO NOT BE VERY ACCURATE SO
C USE THE MAG&PHASE BEFORE THE INVERSE
c     OPEN(UNIT=2,FILE='C:\msdev\projects\FRF2\ww\RESPFUNCs2b12ww') !FRF
C USE FORCINGSQWW.TXT FOR FRF(WSW/AOA) NORMALIZED, USE FORCINGSQPN.txt FOR FRF(PT/PT) NORM
ALIZED
      OPEN(UNIT=1,FILE='C:\msdev\projects\Dbrc\forcingsqpn.txt')!forcing function
c     OPEN(UNIT=1,FILE='C:\msdev\projects\frf2\pt\inletpts2a12.dat')!forcing function
      OPEN(UNIT=3,FILE='C:\msdev\projects\DBRC\RESPONSEs1a12pa2')
      OPEN(UNIT=4,FILE='C:\MSDEV\PROJECTS\frf2\pt\MAG&PHASEs1a12pa2')
      N=13
      NN=N/2.
      RHO =.0738 !LBM/FT^3
      RHO=RHO/.062428 !KG/M^3
      U=2100.  !MACHINE SPEED IN RPM
      U=U*2.*PI/60. !RAD/S
      UTIP=U*.228346 !m/s
      PAMB=30.22*3386.388 !PASCALS

C CURRENTLY THE LOGIC IS ONLY SET-UP FOR THE FRF CALCULATION NOT THE 1ST
C OR SECOND ORDER RESPONSE YET.

c     DO 5 I=0,N-1
c     READ(2,'(E15.7)') H(I)
c     PRINT *, H(I)
c5    CONTINUE

      DO 10 I=0,N-1
c     READ(1,'(E15.7)') A(I)
      READ(1,'(E15.7)') ptrel(I)
      PTREL(I)=PTREL(I)+(PAMB/(.5*RHO*UTIP**2))
      A(I)=PTREL(I)
      avg=a(i)+avg
c     READ(1,'(F9.6)') A(I)
      PRINT *, A(I)
10    CONTINUE
      AVG=AVG/N
      DO 12 I=0,N-1
      A(I)=A(I)/AVG
      PRINT *, A(I)
12    CONTINUE
C IF N IS ODD THEN (N-1)/2, IF N IS EVEN THEN N/2
      DO 15 I=0,(N-1)/2
      READ(4,'(2E15.7)') MAG(I), PHASE(I)
15    CONTINUE

c     CALL SPDFTR(H,HH,N)
      CALL SPDFTR(A,AA,N)

c     PRINT *,'MAGR    PHASER'
c      DO 20 I=0,(N-1)/2
c     MAGR(I)=((AIMAG(HH(I))**2+REAL(HH(I))**2)**.5)
c     MAGR(I)=MAGR(I)*((AIMAG(AA(I))**2+REAL(AA(I))**2)**.5)
```

```
c          PHASER(I)=ATAN2(AIMAG(HH(I)),REAL(HH(I)))+ATAN2(AIMAG(AA(I)),REAL(
c     1AA(I)))
c      PRINT *, MAGR(I), PHASER(I)
c20     CONTINUE


      DO 25 I=0,(N-1)/2
      MAG(I)=MAG(I)*((AIMAG(AA(I))**2+REAL(AA(I))**2)**.5)
      PHASE(I)=PHASE(I)+ATAN2(AIMAG(AA(I)),REAL(A
     1A(I)))
25    CONTINUE

C CALCUATE THE RESPONSE IN THE FREQUENCY DOMAIN (REAL AND IMAGINARY PARTS)
c     DO 30 I=0,(N-1)/2
c     RE(I)=MAGR(I)*COS(PHASER(I))
c     IM(I)=MAGR(I)*SIN(PHASER(I))
c     BB(I)=CMPLX(RE(I),IM(I))
c30   CONTINUE

      DO 35 I=0,(N-1)/2
      RE(I)=MAG(I)*COS(PHASE(I))
      IM(I)=MAG(I)*SIN(PHASE(I))
      CC(I)=CMPLX(RE(I),IM(I))
35    CONTINUE

c      CALL SPIDTR(BB,B,N)
      CALL SPIDTR(CC,C,N)
      DO 40 I=0,N-1
c     B(I)=B(I)/N
      C(I)=C(I)/N
40    CONTINUE

      WRITE(3,45)
45    FORMAT(2X,'HARMONICS',1X,'INLET_PT',1X,'FRF_RESPONSE')
      DO 50 I=0,N-1
      WRITE(3,'(I3,2E15.7)') I, A(I), C(I)
50    CONTINUE


      END




           SUBROUTINE SPDFTR(X,Y,N)
C-LATEST DATE: 10/26/90
C-COMPUTES THE DFT OF A REAL VECTOR X CONTAINING N DATA SAMPLES.
C-X IS DIMENSIONED X(0:N-1) OR LARGER.
C-Y IS COMPLEX Y(0:N/2) IF N EVEN, OR Y(0:(N-1)/2) IF N ODD.
C-INPUTS ARE X(0),X(1),...,X(N-1) AND N=NUMBER OF DATA SAMPLES.
C-OUTPUTS Y(0),Y(1),...,Y(N/2) IF N EVEN, OR Y(0),Y(1),...,
C-  Y((N-1)/2) IF N ODD, ARE THE COMPLEX DFT COMPONENTS, WITH
C-  COSINE COMPONENT=REAL PART AND SINE COMPONENT=IMAGINARY PART.
C-Y AND X CANNOT BE THE SAME ARRAY.
      REAL X
      DIMENSION X(0:N-1)
      COMPLEX Y(0:N/2),TPJN
      TPJN=CMPLX(0.,-8.*ATAN(1.)/N)
      DO 2 M=0,N/2
        Y(M)=X(0)
        DO 1 K=1,N-1
          Y(M)=Y(M)+X(K)*EXP(TPJN*K*M)
    1   CONTINUE
    2 CONTINUE
      RETURN
      END


C-******************************************************************
C-
      SUBROUTINE SPIDTR(Y,X,N)
C-LATEST DATE: 11/12/85
```

```
C-SAME AS SPDFTR EXCEPT REVERSED; Y=SPECTRUM, X=OUTPUT TIME SERIES.
C-SPECTRAL DATA IS ASSUMED TO BE IN COMPLEX Y(0) THRU Y(N/2).
C-N=TIME SERIES LENGTH SHOULD BE EVEN.  TIME SERIES (SCALED BY N)
C-IS COMPUTED IN X(0) THRU X(N-1).  COMPLEX Y(0:N/2) AND DIMENSION
C-X(0:N-1) ARE ASSUMED, ALTHOUGH THE ARRAYS MAY BE LARGER.
      REAL X
      DIMENSION X(0:N-1)
      COMPLEX Y(0:N/2),TPJN
      TPJN=CMPLX(0.,8.*ATAN(1.)/N)
      DO 2 K=0,N-1
        X(K)=Y(0)+Y(N/2)*(-1)**K
        DO 1 M=1,N/2-1
          X(K)=X(K)+2.*REAL(Y(M)*EXP(TPJN*K*M))
    1   CONTINUE
    2 CONTINUE
      RETURN
      END
C-
C-*******************************************************************
```