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MOMENTS OF MODE SHAPES OF TRUCK ACOUSTICS PROBLEMS
!
!
!   USING HYBRID PDD METHOD
!
!
!   =====
!
!   COMPILING THIS PROGRAM ON WINDOWS, USING ifort COMPILER GIVE THE FOLLOWING COMMAND:
!
!   ifort -o POR por_ear_simulation.f90 %LINK_FNL%
!
!   POR
!
!   =====
!
!   IMPLICIT REAL*8 (A-H,O-Z)
!   REAL*8  YASAMP(1000000),YFSAMP(1000000),YHSAMP(1000000)
!   REAL*8  YAPRINT(200,1000000),YFPRINT(200,1000000)
!   REAL*8  YHPRINT(200,1000000)
!
!   OPEN(10,FILE='POR_APDD_SAMPLES.DAT',STATUS='UNKNOWN')
!   OPEN(20,FILE='POR_FPDD_SAMPLES.DAT',STATUS='UNKNOWN')
!   OPEN(30,FILE='POR_HPDD_SAMPLES.DAT',STATUS='UNKNOWN')
!   OPEN(40,FILE='POR_ALFA.DAT',STATUS='UNKNOWN')
!
!
!   DO IFREQ = 1,200
!
!   PRINT*, 'FREQUENCY ', IFREQ, 'OF 200'
!
!   CALL HYBRID(IFREQ,YASAMP,YFSAMP,YHSAMP,YALFA)
!
!   WRITE(40, '(F15.10)') YALFA
!   DO ISAMP = 1,10000
!     YAPRINT(IFREQ,ISAMP) = YASAMP(ISAMP)
!     YFPRINT(IFREQ,ISAMP) = YFSAMP(ISAMP)
!     YHPRINT(IFREQ,ISAMP) = YHSAMP(ISAMP)
!   ENDDO
!
!   ENDDO
!
!   DO ISAMP = 1,10000
!     WRITE(10, '(200E25.15)')( YAPRINT(I,ISAMP),I=1,200 )
!     WRITE(20, '(200E25.15)')( YFPRINT(I,ISAMP),I=1,200 )
!     WRITE(30, '(200E25.15)')( YHPRINT(I,ISAMP),I=1,200 )
!   ENDDO
!
!   CLOSE(10)
!   CLOSE(20)
!   CLOSE(30)
!
!   STOP
!   END
!
!   =====
!
!   SUBROUTINE HYBRID(IFREQ,YAMCS,YFMCs,YHMCs,ALFAIL)
!
!     USE UMACH_INT
!     USE RNSET_INT
!     USE RNUNF_INT
!     USE ANORIN_INT
!     IMPLICIT REAL*8 (A-H,O-Z)
!     REAL*8  X(:),YMCS(:),HMCs(:,:),
!     REAL*8  YAMCS(10000),YFMCs(10000),YHMCs(10000)
!     REAL*8  ALFA(:,:),HIJ(:,:),XQMC(:)
!     REAL*8  PF(:)
!     REAL*8  USUM(:)
!     INTEGER ISEED, NOUT
!     CHARACTER (LEN=280420) :: STRING1
!     CHARACTER (LEN=30) :: SWRITE
!
!     ALLOCATABLE ALFA,X,PF,USUM,YMCS,HMCs,HIJ,XQMC
!
!     PI = 4.*DATAN(1.0D0)
!     N = 53
!     NBAS = 2
!     NSAMP = 500
!
!     OPEN(500,FILE='RESPONSE_POR.DAT',STATUS='UNKNOWN')
!
!     OPEN(1000,FILE='SOBOL_POINTS.DAT', STATUS='OLD', &
!       ACCESS='SEQUENTIAL', FORM='FORMATTED')
!
!     ALLOCATE (ALFA(N,NBAS),YMCS(NSAMP),HMCs(N,NBAS,NSAMP), &
!       X(N),XQMC(N), PF(NBAS),USUM(N), &
!       HIJ(N,NBAS) )
!
!     INITIALIZE COEFFICIENTS
!
!     Y0 = 0.D0
!     DO I = 1,N
!       DO J = 1,NBAS
!         ALFA(I,J) = 0.D0
!       ENDDO
!     ENDDO
!
!     ISKIP = 20*(IFREQ-1)
!     IF (IFREQ.EQ.1) THEN
!       WRITE ( SWRITE, '(A10)' ) '(A1,G20.9)'
!     ELSE
!       WRITE ( SWRITE, '(A2,I6,A7)' ) '(A',ISKIP,',G20.9)'
!     ENDIF
!
!     PRINT*,SWRITE
!
!     STORE RESPONSE FUNCTION AT SAMPLE-POINTS
!
!     DO ISAMP = 1,NSAMP
!       READ(500,SWRITE)STRING1, YREAD
!       YRMS = DABS(YREAD)/DSQRT(2.D0)
!       YREF = 2.0E-5
!       YMCS(ISAMP) = 20.D0*DLOG10(YRMS/YREF)
!     ENDDO
!     CLOSE(500)
!
!     Y0 = 0.D0
!     DO ISAMP = 1,NSAMP
!       READ(1000, '(53E25.15E3)', IOSTAT=IOS) ( XQMC(I), I = 1,N )
!       Y0 = Y0 + YMCS(ISAMP)
!       DO I = 1,N
!         X(I) = 2.D0*XQMC(I) - 1.D0
!         CALL BASIS (X(I),PSIF,NBAS,PF)
!       DO J = 1,NBAS
!         HMCs(I,J,ISAMP) = PF(J)
!       ENDDO
!     ENDDO
!     ENDDO
!     CLOSE(1000)
!
!     Y0 = Y0/DFLOAT(NSAMP)
!
!     VARAPDD = 0.D0
!     DO I = 1,N
!       DO J = 1,NBAS
!         YIU = 0.D0
!         DO ISAMP = 1,NSAMP
!           YIU = YIU + YMCS(ISAMP)*HMCs(I,J,ISAMP)
!         ENDDO
!         ALFA(I,J) = YIU/DFLOAT(NSAMP)
!       ENDDO
!     ENDDO
!
!     CALCULATE APDD AND FPDD VARIANCE FROM SAMPLE-POINTS
!
!     OPEN(1000,FILE='SOBOL_POINTS.DAT', STATUS='OLD', &
!       ACCESS='SEQUENTIAL', FORM='FORMATTED')
!
!     YMC0 = 0.D0
!     YMOM2 = 0.D0
!     YADD1 = 0.D0
!     YADD2 = 0.D0
!     YFDD1 = 0.D0
!     YFDD2 = 0.D0
!     YTOP = 0.D0
!     YBOT = 0.D0
!     DO ISAMP = 1,NSAMP
!
!     READ(1000, '(53E25.15E3)') ( XQMC(I), I = 1,N )
!
!     YADD = Y0
!     DO I = 1,N
!       X(I) = 2.D0*XQMC(I) - 1.D0
!       CALL BASIS (X(I),PSIF,NBAS,PF)
!       DO J = 1,NBAS
!         YADD = YADD + ALFA(I,J)*PF(J)
!       ENDDO
!     ENDDO
!     YADD2 = YADD2 + YADD**2
!
!     YWADD = YADD - Y0
!
!     YFDD = Y0
!     DO I = 1,N
!       X(I) = 2.D0*XQMC(I) - 1.D0
!       CALL BASIS (X(I),PSIF,NBAS,PF)
!       YFSUM = 0.D0
!       DO J = 1,NBAS
!         YFSUM = YFSUM + ALFA(I,J)*PF(J)
!       ENDDO
!       YFDD = YFDD*(1.D0+(1.D0/Y0)*YFSUM)
!     ENDDO
!     YFDD2 = YFDD2 + YFDD**2
!
!     YWFDD = YFDD - Y0
!
!     YWMCS = YMCS(ISAMP) - Y0
!
!     YTOP = YTOP + (YWMCS - YWFDD)*(YWADD - YWFDD)
!     YBOT = YBOT + (YWADD - YWFDD)**2
!
!     ENDDO
!     CLOSE(1000)
!
!     YADD2 = YADD2/DFLOAT(NSAMP)
!     VARAPDD = YADD2 - Y0**2
!
!     YFDD2 = YFDD2/DFLOAT(NSAMP)
!     VARFPDD = YFDD2 - Y0**2
!
!     YTOP = YTOP/DFLOAT(NSAMP)
!     YBOT = YBOT/DFLOAT(NSAMP)
!
!     ALFAIL = YTOP/YBOT
!
!     BITAIL = 1.D0 - ALFAIL
!
!     VARHPDD = ( ALFAIL**2 + 2*ALFAIL*BITAIL )*VARAPDD &
!       + BITAIL**2*VARFPDD
!
!     ISEED = 123457
!     CALL RNSET( ISEED)
!     DO ISAMP = 1,10000
!       DO I = 1,N
!         X(I) = D RNUNF()
!       X(I) = 2.D0*X(I) - 1.D0
!     CALL BASIS (X(I),PSIF,NBAS,PF)
!     DO J = 1,NBAS
!       HIJ(I,J) = PF(J)
!     ENDDO
!     ENDDO
!
!     YADSUM = Y0
!     YMU = Y0
!     DO I = 1,N
!       YFSUM = 0.D0
!       DO J = 1,NBAS
!         YFSUM = YFSUM + ALFA(I,J)*HIJ(I,J)
!       YADSUM = YADSUM + ALFA(I,J)*HIJ(I,J)
!     ENDDO
!     YMU = YMU*(Y0+YFSUM)/Y0
!
!     ENDDO
!
!     YHYB = ALFAIL*YADSUM + BITAIL*YMU
!
!     YAMCS(ISAMP) = YADSUM
!     YFMCs(ISAMP) = YMU
!     YHMCs(ISAMP) = YHYB
!
!     ENDDO
!
!     RETURN
!     END
!
!     *****
!
!     SUBROUTINE BASIS (XI,PSIF,IDEG,PF)
!
!     DEFINES LEGENDRE POLYNOMIALS - NORMALIZED W.R.T. U(-1,1) PDF
!     ALREADY INCLUDED HN Y0
!
!     IMPLICIT REAL*8 (A-H,O-Z)
!     REAL*8  XI,PSIF,PF(IDEG)
!
!     PF(1) = XI
!     PF(2) = (1./2.)*(3.*XI**2 - 1.)
!     DO J = 3,IDEG
!       PF(J) = (1./DFLOAT(J))*( (2.*DFLOAT(J)-1.) *XI*PF(J-1) &
!         - DFLOAT(J-1)*PF(J-2) )
!     ENDDO
!     DO J = 1,IDEG
!       PF(J) = PF(J)*DSQRT(2.*DFLOAT(J)+1.)
!     ENDDO
!
!     PSIF = PF(IDEG)
!
!     RETURN
!     END
!
!     *****
!

```