

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 MOD44 mode_44_moments.f90 %LINK_FNL%

MOD44

IMPLICIT REAL*8 (A-H,O-Z)

OPEN(10,FILE='MODE_44_MEAN.DAT',STATUS='UNKNOWN')
OPEN(20,FILE='MODE_44_AVAR.DAT',STATUS='UNKNOWN')
OPEN(30,FILE='MODE_44_FVAR.DAT',STATUS='UNKNOWN')
OPEN(40,FILE='MODE_44_HVAR.DAT',STATUS='UNKNOWN')
OPEN(50,FILE='MODE_44_ALFA.DAT',STATUS='UNKNOWN')

DO INODE = 1,14021

PRINT*, 'NODE ', INODE, 'OF 14021'

CALL HYBRID(INODE,YMEAN,YAVAR,YFVAR,YHVAR,YALFA)
WRITE(10,'(I10,A1,E25.15)') INODE,',', YMEAN
WRITE(20,'(I10,A1,E25.15)') INODE,',', YAVAR
WRITE(30,'(I10,A1,E25.15)') INODE,',', YFVAR
WRITE(40,'(I10,A1,E25.15)') INODE,',', YHVAR
WRITE(50,'(I10,A1,F25.10)') INODE,',', YALFA

ENDDO

CLOSE(10)
CLOSE(20)
CLOSE(30)
CLOSE(40)
CLOSE(50)

STOP
END

SUBROUTINE HYBRID(INODE,Y0,VARAPDD,VARFPDD,VARHPDD,ALFAIL)

USE UMACH_INT
USE RNSET_INT
USE RNNOR_INT
USE RNUN_INT
USE ANORIN_INT

IMPLICIT REAL*8 (A-H,O-Z)
REAL*8 X(:),YMCS(:),HMCS(:, :, :),YFMC(:)
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,YFMC,YMCS,HMCS,HIJ,XQMC

PI = 4.*DATAN(1.0D0)
N = 53
NBAS = 3
NSAMP = 500

OPEN(500,FILE='RESPONSE_MODE_44.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),YFMC(NSAMP), &
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*(INODE-1)
IF (INODE.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
YYU = 0.D0
DO ISAMP = 1,NSAMP
YYU = YYU + YMCS(ISAMP)*HMCS(I,J,ISAMP)
ENDDO
ALFA(I,J) = YYU/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

RETURN
END

SUBROUTINE BASIS (XI,PSIF,IDEG,PF)

DEFINES LEGENDRE POLYNOMIALS - NORMALIZED W.R.T. U(-1,1) PDF
ALREADY INCLUDED IN 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
