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DECUS NO.	8-347
TITLE	DUBAVG
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SOURCE LANGUAGE	PAL-D

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ABSTRACT

DUBAVG is a subroutine which collects high speed data, smooths via two word arithmetic averaging, and scales the result to millivolts. As many as 4096 runs of 2048 points each may be averaged, limited only by the word length of the runs counter and size of the core field which contains the double word length sum, respectively.

The program has been optimized to allow both the minimum (adjustable) point spacing and the maximum run repetition rate. Minimum point spacing is about 35 microseconds. DUBAVG is core field relocatable, and allows its buffer and sum storage to occupy any core fields whatever.

```
/ASSEMBLER DEFINITIONS FOR DUBAVG
/
FETCHP=65
SPDIVP=100
ZTEN=6342
OTEN=6344
XRCL=6334
ADAC=6375
SKAD=6332
MADC=6377
DUBAVG=200
DAVG2=400
/END OF DEFINITIONS


@/VERSION B
*DUBAVG
/**************************************************
/SUBROUTINE DUBAVG
/**************************************************
/
/CALLING SEQUENCE:  (ALL ARG ARE ADDRESSES)
/       EFFECTIVE JMS DUBAVG
/       AD CHANNEL NUMBER
/       NUMBER OF DATA POINTS
/       TIME DELAY FACTOR
/       DATA FIELD OF BUFFER
/       BASE OF BUFFER ARRAY
/       DATA FIELD FOR SUM STORAGE
/       BASE OF SUM ARRAY
/       NUMBER OF AVERAGES
/
/DATA COLLECTION VIA THE AX08, FOLLOWED BY ARITHMETIC
/SIGNAL AVERAGING.
/
/AS MANY AS 4096 (DEC) RUNS MAY BE AVERAGED, WITH
/AS MANY AS 2048 DATA POINTS PER RUN.  THE SPACING
/OF DATA POINTS IS ADJUSTABLE BETWEEN 35 MICROSEC
/AND ABOUT 18 MSEC. SCALING TO MILLIVOLTS
/IS ACCOMPLISHED BY MULTIPLICATION OF THE RAW DATA BY
/FOUR.
/
/REQUIRED ANCILLARY PROGRAMS:
/       FETCH
/       SINGLE PRECISION DIVIDE (SIGNED)
/
/PAGE ZERO LOCATIONS:
/       AUTOINDEX 10,15,16,17
/       SUBROUTINE POINTER CALLED SPDIVP
/
/
```

```
0200  0000  DUBAVG, 0
0201  4465         JMS I FETCHP     /FETCH ARGUMENT LIST
0202  0010         10               /NR ARGUMENTS
0203  0000  NCHAN,  0
0204  0000  NOPTS,  0
0205  0000  DLAY,   0
0206  0000  DFBUFF, 0
0207  0000  BUFFS,  0
0210  0000  DFSUM,  0
0211  0000  SUMSTO, 0
0212  0000  RUNS,   0
0213  1603         TAD I NCHAN
0214  3203         DCA NCHAN
0215  1605         TAD I DLAY
0216  7041         CIA
0217  3205         DCA DLAY
                   /
                   /SET UP DATA FIELD CHANGE INSTRUCTIONS
                   /
0220  1610         TAD I DFSUM
0221  1373         TAD K6201
0222  3250         DCA CHGZ
0223  6214         RDF
0224  1373         TAD K6201
0225  3254         DCA RSTDF
0226  1606         TAD I DFBUFF
0227  1373         TAD K6201
0230  3266         DCA CHGX
0231  1254         TAD RSTDF
0232  3315         DCA RSTORE
0233  1266         TAD CHGX
0234  3333         DCA CHG1
0235  1250         TAD CHGZ
0236  3342         DCA CHG2
0237  1254         TAD RSTDF
0240  3354         DCA RSTRE
                   /
                   /CLEAR SUM STORAGE
                   /
0241  7240         CLA CMA
0242  1611         TAD I SUMSTO
0243  3010         DCA 10
0244  1604         TAD I NOPTS
0245  7104         CLL RAL          /MULT BY TWO
0246  7041         CIA
0247  3374         DCA PNTCTR
0250  7402  CHGZ,  7402
0251  3410         DCA I 10         /THE CLEAR LOOP
0252  2374         ISZ PNTCTR
0253  5251         JMP .-2
0254  7402  RSTDF,  7402
```

```
0255  1612          TAD I RUNS       /INIT RUNS COUNTER
0256  7041          CIA
0257  3375          DCA RUNCNT
                    /
                    /COLLECT THE DATA
                    /
0260  7240  RPT1,   CLA CMA
0261  1607          TAD I BUFFS      /BASE ADD DATA STORAGE
0262  3010          DCA 10
0263  1604          TAD I NOPTS
0264  7041          CIA
0265  3374          DCA PNTCTR
0266  7402  CHGX,   7402
0267  6342          ZTEN             /CLEAR ENABLE
0270  7001          IAC
0271  6344          OTEN             /PULSE RISE S0
0272  7040          CMA
0273  6334          XRCL             /PULSE FALL S0
0274  7300          CLA CLL
0275  1203          TAD NCHAN
0276  6375          ADAC             /SEL AND CONVERT
0277  6332  FIRST,  SKAD
0300  5277          JMP FIRST
0301  7200          CLA
0302  1203  REPIT,  TAD NCHAN
0303  6377          MADC             /SEL READ AND  CONV
0304  3410          DCA I 10
0305  1205          TAD DLAY
0306  3376          DCA TIMER
0307  2376  DELAY,  ISZ TIMER
0310  5307          JMP DELAY
0311  6332  HOLD,   SKAD
0312  5311          JMP HOLD
0313  2374          ISZ PNTCTR
0314  5302          JMP REPIT
0315  7402  RSTORE, 7402
                    /
                    /AVERAGE WITH PAST RUNS
                    /
0316  1604          TAD I NOPTS
0317  7041          CIA
0320  3374          DCA PNTCTR
0321  7240          CLA CMA
0322  1607          TAD I BUFFS
0323  3017          DCA 17
0324  7240          CLA CMA
0325  1611          TAD I SUMSTO
0326  3016          DCA 16
0327  1016          TAD 16
0330  3015          DCA 15
0331  7340  DUBADD, CLA CLL CMA      /CLEAR LINK, SET AC TO -1
```

```
0332  3376            DCA NEGSWT
0333  7402  CHG1,     7402
0334  1417            TAD I 17          /FETCH DATA POINT FROM BUFFER
0335  7104            CLL RAL           /SCALE TO MV: MULT  BY 4
0336  7104            CLL RAL
0337  7100            CLL
0340  7510            SPA
0341  5370            JMP NEGIT
0342  7402  CHG2,     7402
0343  1416  RTN,      TAD I 16          /FETCH LOW ORDER
0344  3415            DCA I 15          /REPLACE SUM IN LOW ORDER
0345  7204            GLK               /CARRY OR BORROW BIT
0346  1416            TAD I 16          /FETCH HIGH
0347  2376            ISZ NEGSWT        /WAS NEW DATUM NEGATIVE?
0350  1377            TAD (7777         /YES. ADD PROPER HIGH ORDER
0351  3415            DCA I 15          /NO. PUT SUM IN HIGH ORDER.
0352  2374            ISZ PNTCTR
0353  5331            JMP DUBADD
0354  7402  RSTRE,     7402
0355  2375            ISZ RUNCNT
0356  5260            JMP RPT1
                      /
                      /DIVIDE BY NR OF RUNS
                      /
0357  7240            CLA CMA
0360  1607            TAD I BUFFS
0361  3017            DCA 17
0362  7240            CLA CMA
0363  1611            TAD I SUMSTO
0364  3016            DCA 16
0365  1200            TAD DUBAVG        /TAKE ALONG EXIT POINTER
0366  5767            JMP I RESTP
0367  0400  RESTP,     REST
0370  2376  NEGIT,     ISZ NEGSWT
0371  7000            NOP
0372  5342            JMP CHG2
0373  6201  K6201,     6201
0374  0000  PNTCTR,     0
0375  0000  RUNCNT,     0
0376  0000  TIMER,      0
                      NEGSWT=TIMER
0377  7777
                      *PAGE   /TRICKS ASSEMBLER TO PRINT LITERALS AND LINKS HERE.
                      *DAVG2
0400  3243  REST,      DCA EXIT
0401  1644            TAD I PTPTR       /FETCH ADDRESS OF NO PTS
0402  3245            DCA AVTMP
0403  1645            TAD I AVTMP       /FETCH NO PTS
0404  7041            CIA
0405  3246            DCA CNTR2
0406  1650            TAD I CHGXP       /FETCH DATA FIELD INSTRUCTION
```

```
0407  3232          DCA CHG3
0410  1651          TAD I CHGZP
0411  3222          DCA CHG4
0412  1652          TAD I RSTDFP
0413  3240          DCA EXT
0414  1240          TAD EXT
0415  3226          DCA LOCDF
0416  1647          TAD I RUNSPT     /FETCH ADD NO RUNS
0417  3245          DCA AVTMP
0420  1645          TAD I AVTMP      /FETCH NO RUNS
0421  3231          DCA DIVISR
0422  7402  CHG4,    7402
0423  1416  RPT2,    TAD I 16         /FETCH LOW ORDER OF SUM
0424  3230          DCA LOORD
0425  1416          TAD I 16         /FETCH HI ORDER
0426  7402  LOCDF,   7402
0427  4500          JMS I SPDIVP     /SIGNED DIVIDE SUBROUTINE
0430  0000  LOORD,   0
0431  0000  DIVISR,  0
0432  7402  CHG3,    7402
0433  7430          SZL
0434  7402          HLT              /HALT ON DIVIDE ERROR
0435  3417          DCA I 17
0436  2246          ISZ CNTR2
0437  5222          JMP CHG4
0440  7402  EXT,     7402
0441  5643          JMP I EXIT
0442  0000  SWITCH,  0
0443  0000  EXIT,    0
0444  0204  PTPTR,   NOPTS
0445  0000  AVTMP,   0
0446  0000  CNTR2,   0
0447  0212  RUNSPT,  RUNS
0450  0266  CHGXP,   CHGX
0451  0250  CHGZP,   CHGZ
0452  0254  RSTDFP,  RSTDF
```

```
ADAC    6375
AVTMP   0445
BUFFS   0207
CHGX    0266
CHGXP   0450
CHGZ    0250
CHGZP   0451
CHG1    0333
CHG2    0342
CHG3    0432
CHG4    0422
CNTR2   0446
DAVG2   0400
DELAY   0307
DFBUFF  0206
DFSUM   0210
DIVISR  0431
DLAY    0205
DUBADD  0331
DUBAVG  0200
EXIT    0443
EXT     0440
FETCHP  0065
FIRST   0277
HOLD    0311
K6201   0373
LOCDF   0426
LOORD   0430
MADC    6377
NCHAN   0203
NEGIT   0370
NEGSWT  0376
NOPTS   0204
OTEN    6344
PNTCTR  0374
PTPTR   0444
REPIT   0302
REST    0400
RESTP   0367
RPT1    0260
RPT2    0423
RSTDF   0254
RSTDFP  0452
RSTORE  0315
RSTRE   0354
RTN     0343
RUNCNT  0375
RUNS    0212
RUNSPT  0447
SKAD    6332
```

```
SPDIVP 0100
SUMSTO 0211
SWITCH 0442
TIMER  0376
XRCL   6334
ZTEN   6342
```

```
*FETCH
/SUBROUTINE FETCH
/
/FETCHES ARGUMENTS FOR SUBROUTINES
/
/CALLING SEQUENCE:
/       200     SUBR,   0
/       201             EFFECTIVE JMS FETCH
/       202             NUMBER OF ARGUMENTS (OCTAL)
/       203     ARG1,   0
/       204     ARG2,   0
/         .       .     .
/         .     ETC., ONE FOR EACH ARGUMENT
/       20-             NEXT EXECUTABLE STATEMENT
/
/FETCH UPDATES THE EXIT OF THE CALLING SUBROUTINE
/PAGE ZERO LOCATIONS REQD:
/       AUTOINDEX 16, 17
/       65
/
/
/
FETCH,  0
        CLA CMA
        TAD FETCH       /POINTER TO STORE ARGUMENTS
        DCA 16
        CLA CLL CMA RAL /SET ACC TO MINUS TWO
        TAD FETCH       /POINTER TO SOURCE ARG LLIST
        DCA FETCH
        CMA
        TAD I FETCH     /GET ARG SOURCE LIST ADDRESS
        DCA 17
        TAD I 16        /FETCH NO OF ARGUMENTS
        CIA
        DCA CNTR
NEXT,   TAD I 17        /FETCH THE ARGUMENT
        DCA I 16        /STORE IT
        ISZ CNTR
        JMP NEXT
        CLA IAC
        TAD 17
        DCA I FETCH     /UPDATE SUBROUTINE EXIT
        JMP I 16        /RETURN TO SUBROUTINE
CNTR,   0
*65
        FETCH
$
```