



# DECUS

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| DECUS NO.       | 8-446                                                           |
| TITLE           | A PATCH TO FFTS-R FOR USE WITHOUT THE EAE                       |
| AUTHOR          | Gregory R. Ruth                                                 |
| COMPANY         | MIT Charles Stark Draper Laboratory<br>Cambridge, Massachusetts |
| DATE            | June 14, 1971                                                   |
| SOURCE LANGUAGE | PAL-8                                                           |

### ATTENTION

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# A PATCH TO FFTS-R FOR USE WITHOUT THE EAE

DECUS Program Library Write-up

DECUS NO. 8-446

## 1. Abstract

This patch permits the use of the Fast Fourier Transform subroutine for real valued functions, written by James E. Rothman (DECUS No. 8-143), on machines without an EAE. Except for speed of execution, the subroutine is in no way affected. Execution times for the subroutine with the patch are about three times longer.

## 2. Requirements

### 2.1 Hardware

The minimum necessary hardware is a 4K PDP-8 (8/I, 8/L, or 8/E).

### 2.2 Storage

In addition to the storage required for FFTS-R, 136<sub>8</sub> locations are required. Four of these must be on page zero in the field in which FFTS-R resides. The others may be virtually anywhere else in the same field.

## 3. Loading Procedure

Load as you would any overlay.

## 4. Execution Times

The following is a table of approximate execution times for the subroutine with this patch.

| <u>Number of Points Transformed</u> | <u>Time (seconds)</u> |
|-------------------------------------|-----------------------|
| 2048                                | 14.9                  |
| 1024                                | 6.8                   |
| 512                                 | 3.0                   |
| 256                                 | 1.4                   |
| 128                                 | 0.6                   |
| 64                                  | 0.25                  |

#### 5. Restrictions

None

#### 6. Listing

## /FFT-R PATCH

## /SYMBOL DEFINITIONS

MOL=DCA MQ  
 MOA=TAD MQ  
 SHL=JMS I SHLOC  
 LSR=JMS I LLOC  
 ASR1=JMS I AS1LOC  
 MUY=JMS I MPLOC

|      |      |       |                 |
|------|------|-------|-----------------|
|      |      | *566  |                 |
| 0566 | 4516 |       | LSR             |
|      |      | *761  |                 |
| 0761 | 4517 |       | ASR1            |
|      |      | *765  |                 |
| 0765 | 4517 |       | ASR1            |
|      |      | *770  |                 |
| 0770 | 1110 |       | MOA             |
|      |      | *1004 |                 |
| 1004 | 3110 |       | MOL             |
|      |      | *1014 |                 |
| 1014 | 7010 |       | RAR             |
|      |      | *1016 |                 |
| 1016 | 4520 |       | MUY             |
|      |      | *1020 |                 |
| 1020 | 4515 |       | SHL             |
|      |      | *1023 |                 |
| 1023 | 1235 |       | TAD SIGN        |
| 1024 | 4515 |       | SHL             |
| 1025 | 0000 |       | 0               |
| 1026 | 1217 |       | 1217            |
| 1027 | 7510 |       | SPA             |
| 1030 | 7350 |       | CLA CLL CMA RAR |
| 1031 | 7000 |       | NOP             |
| 1032 | 7430 |       | SZL             |
| 1033 | 7041 |       | CMA IAC         |
| 1034 | 5600 |       | 5600            |
| 1035 | 0000 | SIGN, | 0               |
|      |      | *1063 |                 |
| 1063 | 3110 |       | MOL             |
|      |      | *1074 |                 |
| 1074 | 4516 |       | LSR             |
|      |      | *1076 |                 |
| 1076 | 4515 |       | SHL             |
|      |      | *1111 |                 |
| 1111 | 4516 |       | LSR             |
|      |      | *1113 |                 |
| 1113 | 4515 |       | SHL             |
|      |      | *1122 |                 |
| 1122 | 4516 |       | LSR             |
|      |      | *1124 |                 |
| 1124 | 4515 |       | SHL             |
|      |      | *1142 |                 |
| 1142 | 4517 |       | ASR1            |

/PART OF PATCH BELOW

/PATCH TO FIX ROUNDING ERROR; SEE  
 /DECUS 8-143 WRITE-UP

/TAD ARG2

\*1146  
 1146 4517 ASR1  
 \*1151  
 1151 1110 MOA  
 \*1160  
 1160 3110 MOL  
 1161 1110 MOA  
 \*1171  
 1171 1110 MOA

\*110  
 0110 0000 MO, 0  
 0111 0000 AC, 0  
 0112 0000 T1, 0  
 0113 0000 T2, 0  
 0114 0000 CTR, 0  
 0115 0221 SHLOC, SH  
 0116 0200 LLOC, LS  
 0117 0241 ASILOC, AA1  
 0120 0271 MPLOC, MP  
 0121 7764 KM12, -14

\*200

# /EAE SHIFT SIMULATORS

0200 0000 LS, 0 /LSR  
 0201 3111 DCA AC  
 0202 1600 TAD I LS  
 0203 7040 CMA  
 0204 3114 DCA CTR  
 0205 2200 ISZ LS  
 0206 1111 LR, TAD AC  
 0207 7110 CLL RAR  
 0210 3111 DCA AC  
 0211 1110 TAD MO  
 0212 7010 RAR  
 0213 3110 DCA MO  
 0214 2114 ISZ CTR  
 0215 5206 JMP LR  
 0216 1111 TAD AC  
 0217 7100 CLL  
 0220 5600 JMP I LS

0221 0000 SH, 0 /SHL  
 0222 3111 DCA AC  
 0223 1621 TAD I SH  
 0224 7040 CMA  
 0225 3114 DCA CTR  
 0226 1110 SPR, TAD MO  
 0227 7104 CLL RAL  
 0230 3110 DCA MO  
 0231 1111 TAD AC  
 0232 7004 RAL  
 0233 3111 DCA AC

/THIS OPERATION ALWAYS CLEARS THE LI

|      |      |     |      |
|------|------|-----|------|
| 0234 | 2114 | ISZ | CTR  |
| 0235 | 5226 | JMP | SHR  |
| 0236 | 1111 | TAD | AC   |
| 0237 | 2221 | ISZ | SH   |
| 0240 | 5621 | JMP | I SH |

|      |      |      |     |           |
|------|------|------|-----|-----------|
| 0241 | 0000 | AA1, | 0   | /ASR ONCE |
| 0242 | 7100 |      | CLL |           |
| 0243 | 7510 |      | SPA |           |
| 0244 | 7120 |      | STL |           |
| 0245 | 7010 |      | RAR |           |
| 0246 | 3111 |      | DCA | AC        |
| 0247 | 1110 |      | TAD | M0        |
| 0250 | 7010 |      | RAR |           |
| 0251 | 7100 |      | CLL |           |
| 0252 | 3110 |      | DCA | M0        |
| 0253 | 1111 |      | TAD | AC        |
| 0254 | 7510 |      | SPA |           |
| 0255 | 7120 |      | STL |           |
| 0256 | 2241 |      | ISZ | AA1       |
| 0257 | 5641 |      | JMP | I AA1     |

|      |      |      |     |           |
|------|------|------|-----|-----------|
| 0260 | 0000 | SH1, | 0   | /SHL ONCE |
| 0261 | 3111 |      | DCA | AC        |
| 0262 | 1110 |      | TAD | M0        |
| 0263 | 7104 |      | CLL | RAL       |
| 0264 | 3110 |      | DCA | M0        |
| 0265 | 1111 |      | TAD | AC        |
| 0266 | 7004 |      | RAL |           |
| 0267 | 2260 |      | ISZ | SH1       |
| 0270 | 5660 |      | JMP | I SH1     |

|      |      |        |     |                                                |
|------|------|--------|-----|------------------------------------------------|
| 0271 | 0000 | MP,    | 0   | /MUY SIMULATOR                                 |
| 0272 | 7200 |        | CLA | /ENTER WITH ARGS FOLLOWING CALL AND IN M0      |
| 0273 | 3111 |        | DCA | AC /EXIT WITH MOST SIGNIFICANT BITS OF PRODUCT |
| 0274 | 1671 |        | TAD | I MP /AND LEAST SIGNIFICANT BITS OF PRODUCT    |
| 0275 | 3112 |        | DCA | T1 /IN THE M0                                  |
| 0276 | 2271 |        | ISZ | MP                                             |
| 0277 | 1121 |        | TAD | KM12                                           |
| 0300 | 3114 |        | DCA | CTR                                            |
| 0301 | 7100 |        | CLL |                                                |
| 0302 | 1110 | MPREP, | TAD | M0                                             |
| 0303 | 7010 |        | RAR |                                                |
| 0304 | 3110 |        | DCA | M0                                             |
| 0305 | 1111 |        | TAD | AC                                             |
| 0306 | 7420 |        | SNL |                                                |
| 0307 | 5312 |        | JMP | ..+3                                           |
| 0310 | 7100 |        | CLL |                                                |
| 0311 | 1112 |        | TAD | T1                                             |
| 0312 | 7010 |        | RAR |                                                |
| 0313 | 3111 |        | DCA | AC                                             |
| 0314 | 2114 |        | ISZ | CTR                                            |
| 0315 | 5302 |        | JMP | MPREP                                          |
| 0316 | 1110 |        | TAD | M0                                             |
| 0317 | 7010 |        | RAR |                                                |

ZFFT-R PATCH

PAL8 6/10/71

0320 7100  
0321 3110  
0322 1111  
0323 5671

CLL  
DCA MO  
TAD AC  
JMP I MP

1

ZFFT-E PATCH

PAL8 6/10/71

|      |      |       |      |
|------|------|-------|------|
| AA1  | 0241 | AC    | 0111 |
| KM12 | 0121 | LLOC  | 0116 |
| MP   | 0271 | MPLOC | 0120 |
| MOL  | 3110 | MUY   | 4520 |
| SPR  | 0226 | SHI   | 0260 |

|       |      |        |      |       |      |
|-------|------|--------|------|-------|------|
| ASR1  | 4517 | AS1LOC | 0117 | CTR   | 0114 |
| LR    | 0206 | LS     | 0200 | LSR   | 4516 |
| MPREP | 0302 | MO     | 0110 | MOA   | 1110 |
| SP    | 0221 | SPL    | 4515 | SPLOC | 0115 |
| SICN  | 1035 | TI     | 0112 | T2    | 0113 |

