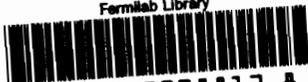
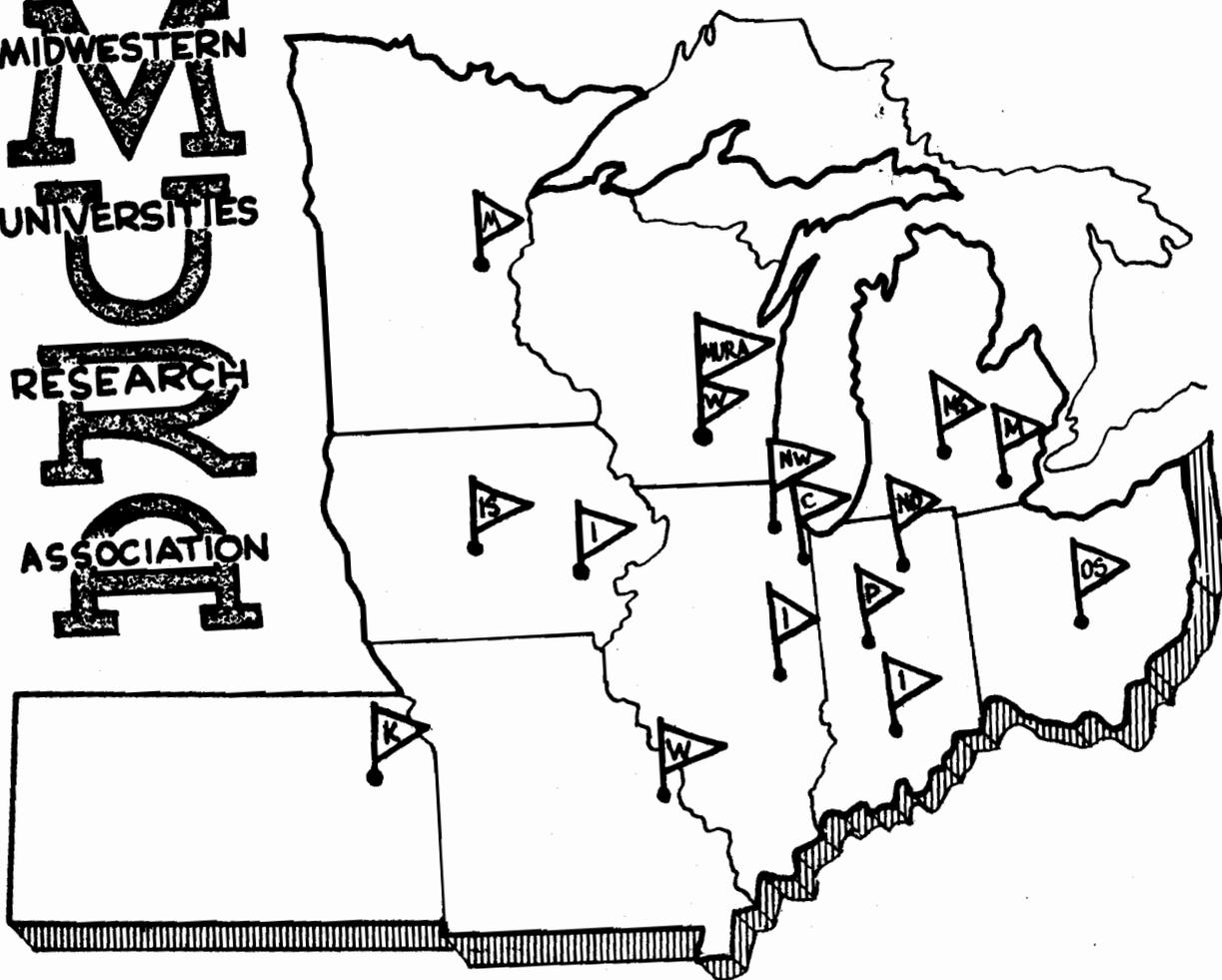


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REPORT SQUAVER III  
(Program 254)  
October, 1959

NUMBER 525  
Computer Program  
Internal

SQUAVER III  
(Program 254)  
M. R. Storm

As a result of a memo from G. Parzen to M. Storm on July 2, 1959, the program SQUAVER III was written to augment the existing SQUAVER II program (MURA-501) in order to provide for a tune and fixed point calculation.

The user enters all necessary data on SQUAVER II Agendum forms with the addition of two extra parameters called  $\epsilon_{\text{tune}}$  and  $\epsilon_{\text{test}}$ , whose addresses are to be specified as 3262 and 3333 respectively.

Starting with the values of  $x$ ,  $p_x$ ,  $y$ ,  $p_y$ , and  $(N\theta/2\pi)_0$ , the program will integrate through 3 sectors and record and print out the values of  $x$ ,  $p_x$ ,  $y$ ,  $p_y$ , and  $N\theta/2\pi$  at the end of each sector. A sector interval is taken to be  $\Delta NP$  integration steps. For convenience sake, the various values will be subscripted as  $x_0, x_1, x_2, x_3$ , or  $(P_x)_0, (P_x)_1, (P_x)_2, (P_x)_3$  where  $x_0$  and  $(P_x)_0$  are the initial values at which the integration began. After the third sector we compute and print out

$$\cos \sigma_x = \frac{1}{2} \left[ \frac{x_3 + x_1 - x_0 - x_2}{x_2 - x_1} \right],$$

$$x_f = x_1 + \frac{(x_2 + x_0 - 2x_1)}{2(1 - \cos \sigma_x)},$$

$$(p_x)_f = (P_x)_1 + \frac{(P_x)_2 + (P_x)_0 - 2(P_x)_1}{2(1 - \cos \sigma_x)}$$

and  $\sigma_x/2\pi$ .

A comparison test is made to check whether  $|x_f - x_0| < \epsilon_{\text{test}}$ . If the result of the test is negative, then the process through the 3 sectors is repeated, however, now substituting for  $x_0$  and  $(P_x)_0$  the values of  $x_f$  and  $(P_x)_f$ . This

iterative scheme is continued until either the test is successful or a maximum of 10 passes have been completed.

Whenever a suitable fixed point is found, a final 3 sector pass is made to determine the y-tune. The initial starting values are set as

$$x = x_f + \epsilon_{\text{tune}}, \quad P_x = (P_x)_f$$

$$y = \epsilon_{\text{tune}}, \quad P_y = 0$$

and the initial value of  $N\theta/2\pi$  becomes  $\left(\frac{N\theta}{2\pi}\right)_0 + \frac{3N}{S}$ . At the end of this pass two lines of print appear. The first consists of four numbers  $\sigma_x/2\pi$ ,  $x_f$ ,  $(P_x)_f$ , and  $\cos \sigma_x$  in that order. The second is labeled NUX + NUy and has three numbers  $\nu_x$ ,  $\sigma_y/2\pi$ , and  $\nu_y$ .

At the option of the user an equilibrium orbit print-out through one sector is possible as the final step in SQUAVER III. If sense switch 3 is in the down position this final print will be produced, printing out the values of  $N\theta/2\pi$ ,  $x$ , and  $P_x$  at every RUNGE-KUTTA integration step. The initial values for this run are taken to be as follows:

$$x = x_f \quad P_x = (P_x)_f \quad y = P_y = 0.$$

If sense switch 3 is in the up position, then the equilibrium orbit run is omitted. The user should clearly mark somewhere on the SQUAVER II Agendum the desired position of this sense switch. At the same time the number II should be replaced by III and the number 254 inserted for 246.

There are no programmed error stops in the SQUAVER III portion although numerous divide check stops are possible with improper numerical data.

MEMO to: Computer Users

From: G. A. Westlund - January 1, 1960

Subject: Squaver IIC and Squaver IIIC (Program 279)

These programs are similar to Squaver II (Program 246) and Squaver III (Program 254) with the following exception requested by George Parzen.

A new magnetic field component,  $B_y^*$ , is calculated and is related to the former  $B_y$  as  $B_y^* = B_y \left\{ 1 + \left[ \cos\left(\frac{j}{w} \ln(A+x) - 2\pi e\right) \right] \left[ d_0 + d_1 \cos(mN\theta - 2\pi f) \right] \right\}$

Data parameters are entered via the standard Squaver II agendum sheets and additional parameters are specified on a supplemental agendum form. The symbols and corresponding addresses of the extra quantities are:

881	j	884	$d_0$
882	e	885	$d_1$
883	f	886	m

It is suggested that this memo become a permanent part of the Squaver II and Squaver III writeups.