MURA 457

December 28, 1959

MEMORANDUM

TO: ILL TEMPERED FIVE Users

FROM: Elizabeth Z. Chapman

DATE: December 15, 1959

SUBJECT: Change in ILL TEMPERED FIVE (Program #220)

Part 1 of ILL TEMPERED FIVE Cyclotron Overwrite 2 now operates in the following way.

The first pass is begun with the initial conditions entered on the agendum sheet. The program then will integrate through 3 n_{RK} steps (3 sectors) and record and print the values of p_x, p_y, x, y, and $N\theta/2\pi$ every n_{RK} steps.

At this time x_f, p_{x_f} are computed from

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

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

where

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

The values of x_f and p_{x_f} are used as new initial conditions for the next pass.

This process will continue until a pass is completed for which

$$|x_f - x_o| < \varepsilon.$$

The final values of x_f and p_{x_f} are printed as the last line of Part 1 with line label 01000. This system is essentially the one suggested for the SQUAVER series by G. Parzen.

If no x_f is found to satisfy the above condition within 10 passes, the program prints the last values for x_f and p_{x_f} with the line label 01111 and proceeds to the next run.

The last line of Part 2 of Cyclotron Overwrite 2 now contains in addition to s_o, v and T, the value of x on the equilibrium orbit averaged through one sector. That is, if x_i is the value of x at the i^{th} integration step, the quantity $\langle x \rangle = \frac{1}{n_{RK}} \sum_{i=o}^{n_{RK}-1} x_i$ is calculated.

The agendum sheet is now the following:

Parameter	Address	Value		Remarks	FLOATING POINT NUMBERS
		n	exp		
ϵ	202			(10^{-6})	
ρ	203			(10^{-5})	
E	204			(1)	

This memorandum should be permanently attached to ILL TEMPERED FIVE, MURA Report No. 457.

MEMORANDUM

TO: ILL TEMPERED FIVE USERS
FROM: Elizabeth Z. Chapman
DATE: October 23, 1959
SUBJECT: Addition to ILL TEMPERED FIVE

ILL TEMPERED FIVE Cyclotron Overwrite 2 now calculates several additional quantities as suggested by F. T. Cole.

For each betatron oscillation mode the program calculates:

1. $\sin\sigma$
2. $\alpha = \left[\frac{x_1 - x_{f_1}}{x_o - x_f} - \cos\sigma\right] \frac{1}{\sin\sigma}$
3. $1 + \alpha^2$
4. $\beta = -(1 + \alpha^2)(\sin\sigma)\left[\frac{x_o - x_f}{p_{x_1} - p_{x_{f_1}}}\right]$
5. $2\alpha\beta$
6. β^2

These quantities are those which appear in the coefficients of the quadratic invariant of linear theory which can be calculated by the program.

Line 03004 of the output contains α_x, β_x, $1 + \alpha_x^2$, $2\alpha_x\beta_x$, β_x^2 respectively and line 04004 contains the corresponding y quantities.

In Part 2 of Cyclotron Overwrite 2 the alternate lines of column 2 (labeled 000n) contain the values of $\lambda(a + x) B_y$ for the preceding point on the equilibrium orbit. This quantity is equal to r/ρ in the units employed and its maximum is directly the circumference factor, C.

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