Fermilab

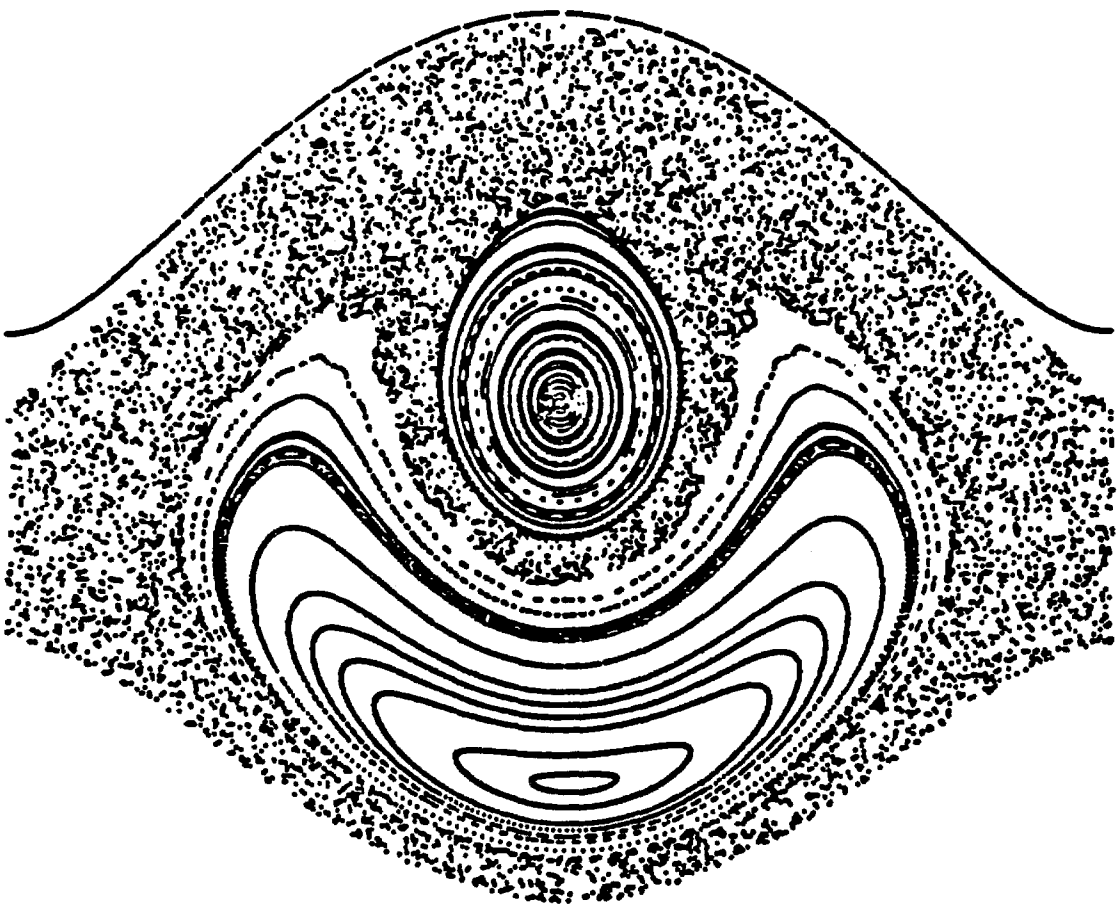
AP-Note-90-003

ACCELERATOR PHYSICS DEPARTMENT

TITLE: A Nonlinear Oscillator

AUTHOR: Ray Tomlin

January 27, 1990



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1-27-90

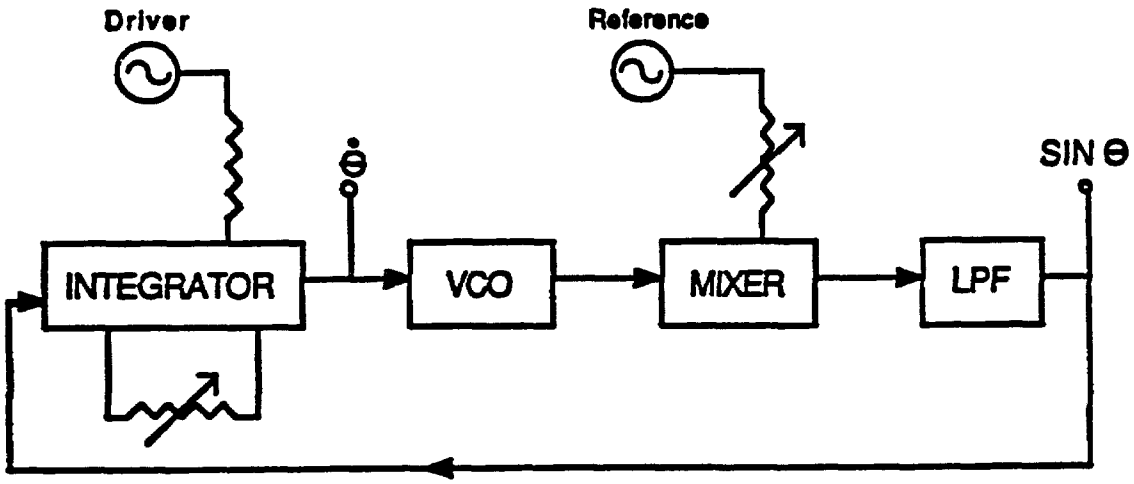
A Nonlinear Oscillator

Ray Tomlin

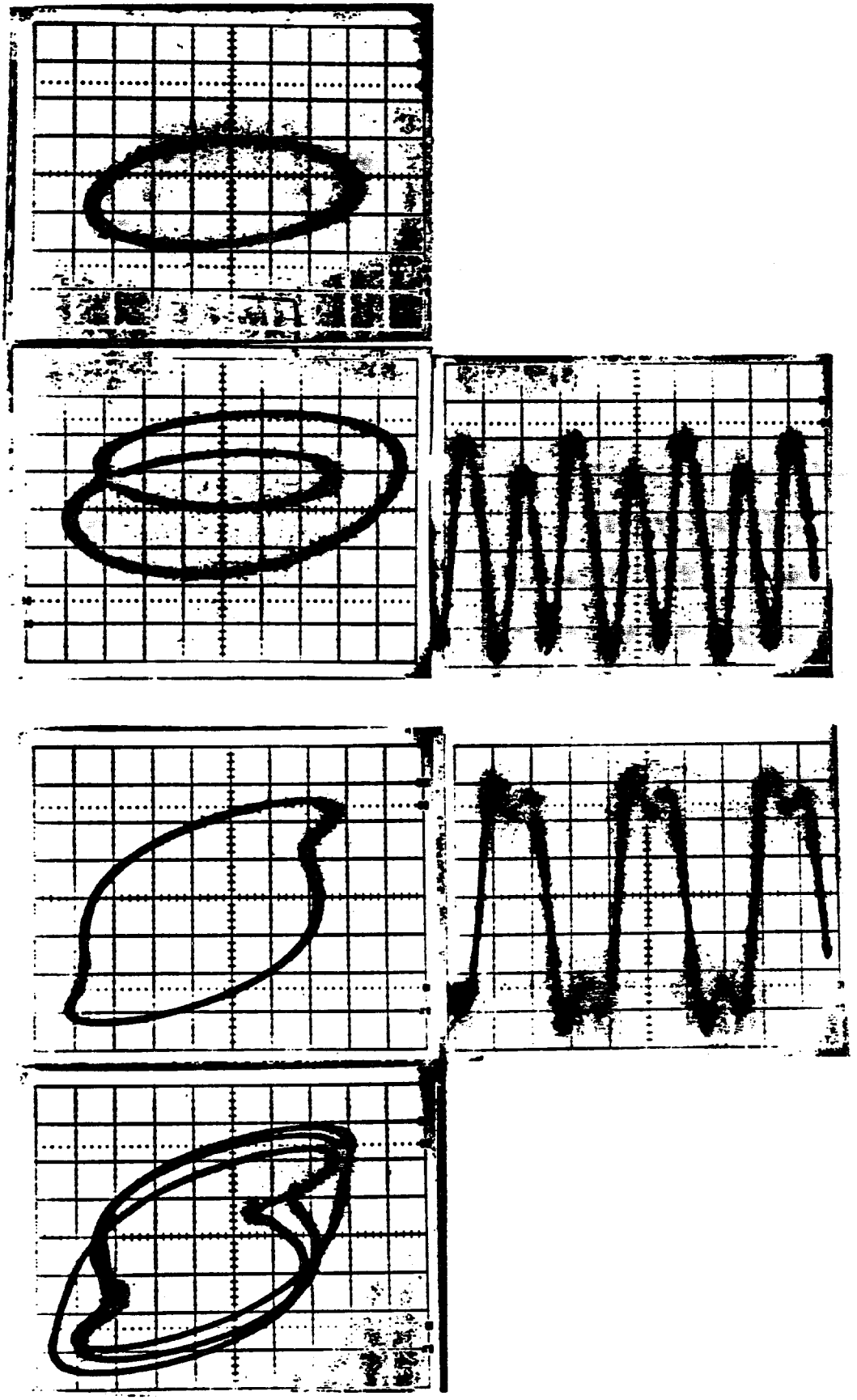
A nonlinear oscillator design was imported from Cornell, modified, and built for the purpose of simulating the chaotic states of a forced pendulum. Similar circuits have been investigated in the recent nonlinear explosion.

Circuit Funtion:

A block diagram shows the circuit which is a phase locked loop. The voltage controled oscillator output is mixed with a reference signal. The result is filtered, integrated, and fed to the VCO as the error correction signal. This VCO locks over a range of approximately 23 to 27KHz. The natural operating frequency of the circuit is approximately 25KHz and is variable with the integrator setting. The low pass filter was breadboarded separately. Its response curve is included here. A VCO input verses frequency out curve for open loop is included.



BLOCK DIAGRAM



12-30-89
R. Tomlin

DSA 602 DIGITIZING SIGNAL ANALYZER
date: 31-DEC-89 time: 10:49:04

Figure b.
Bifurcation with the third frequency appearing and spectrum shifted down.

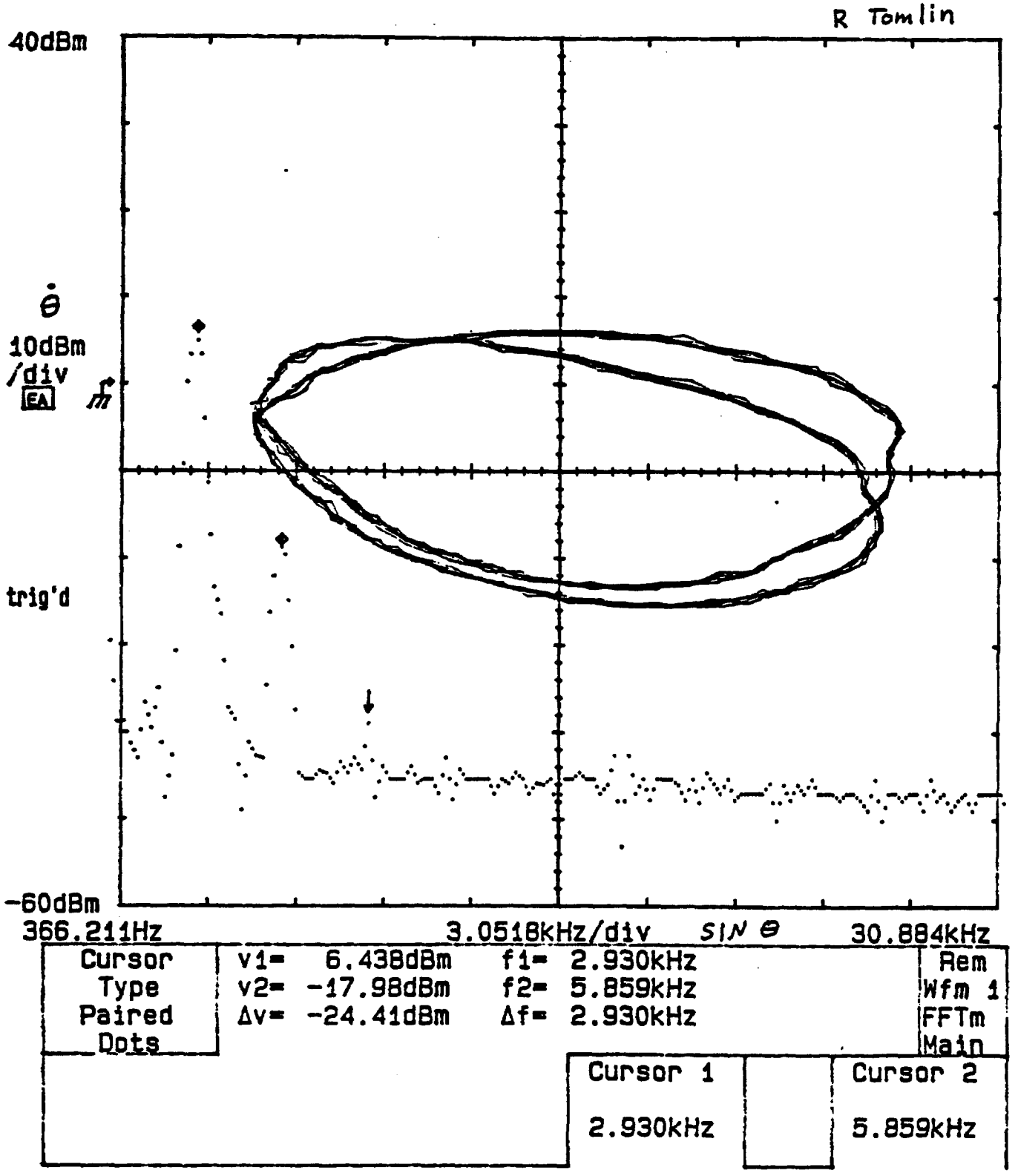


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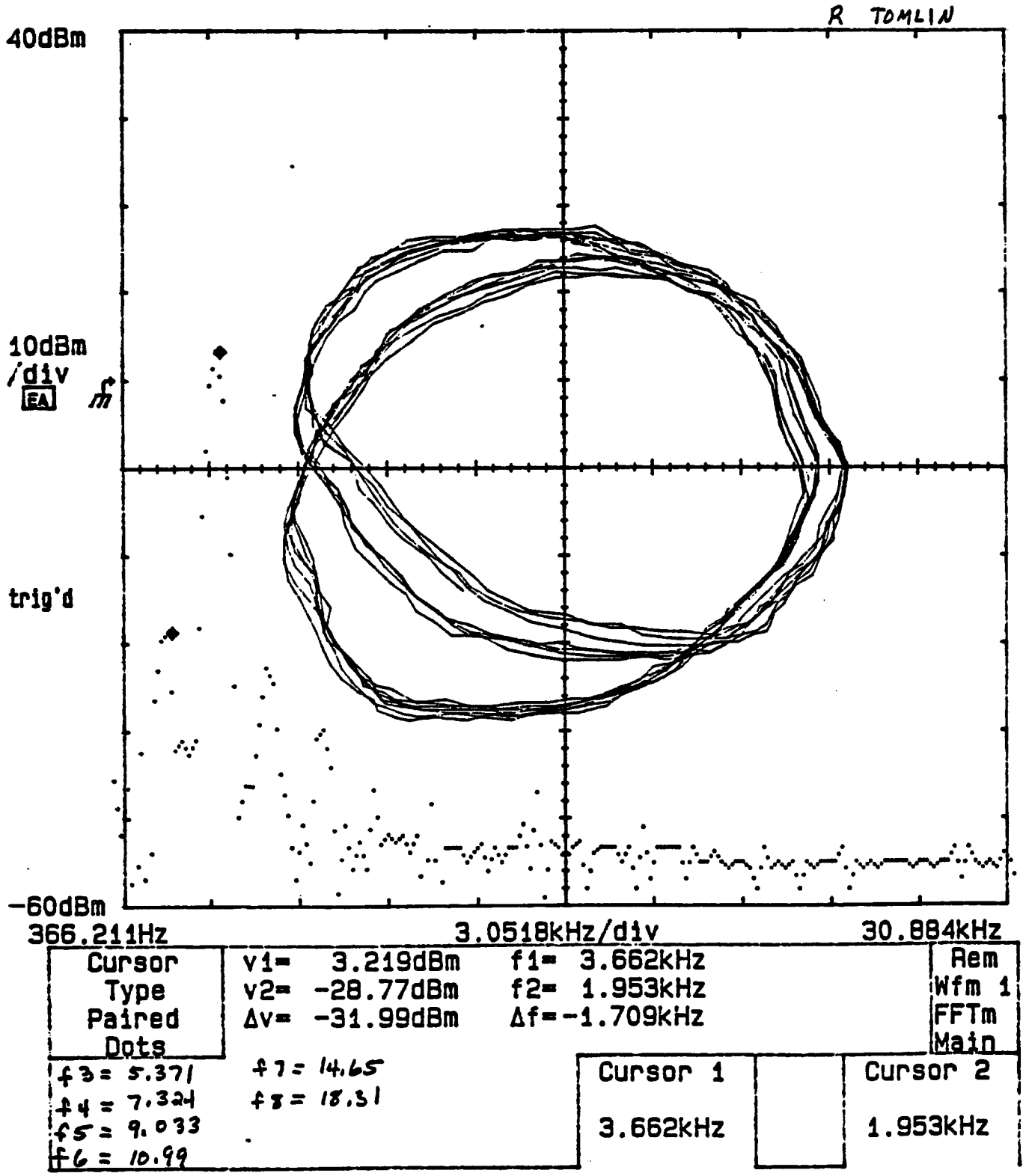
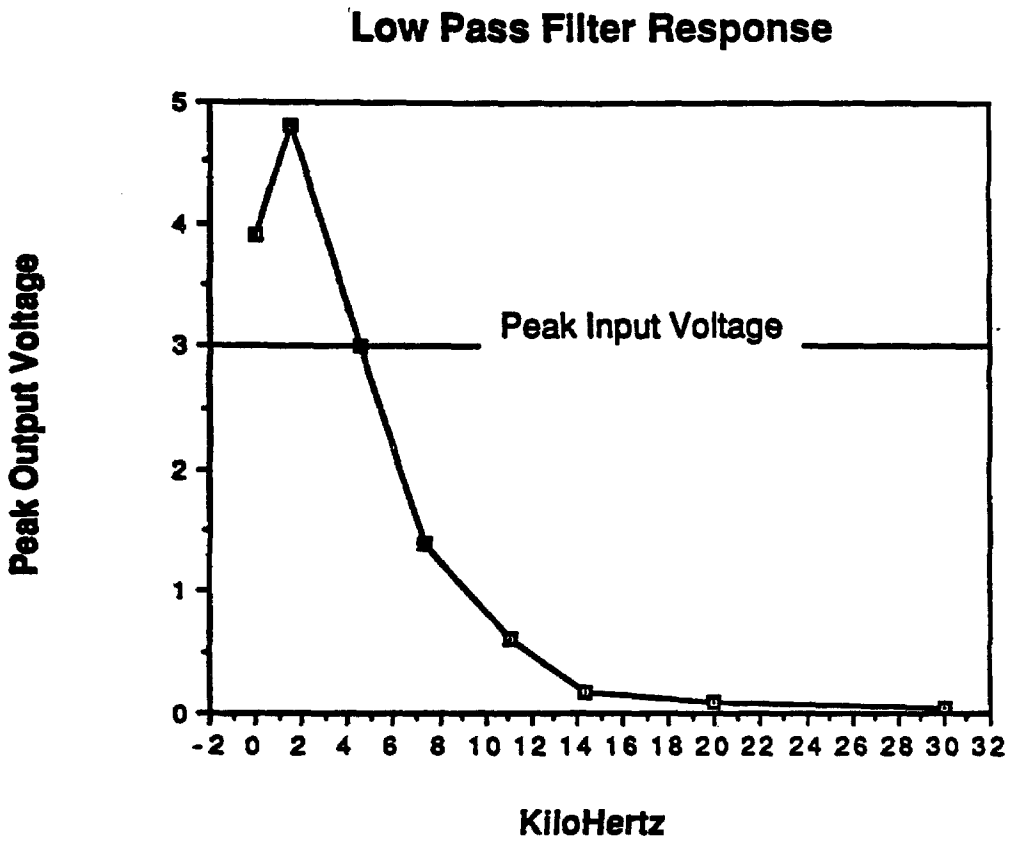
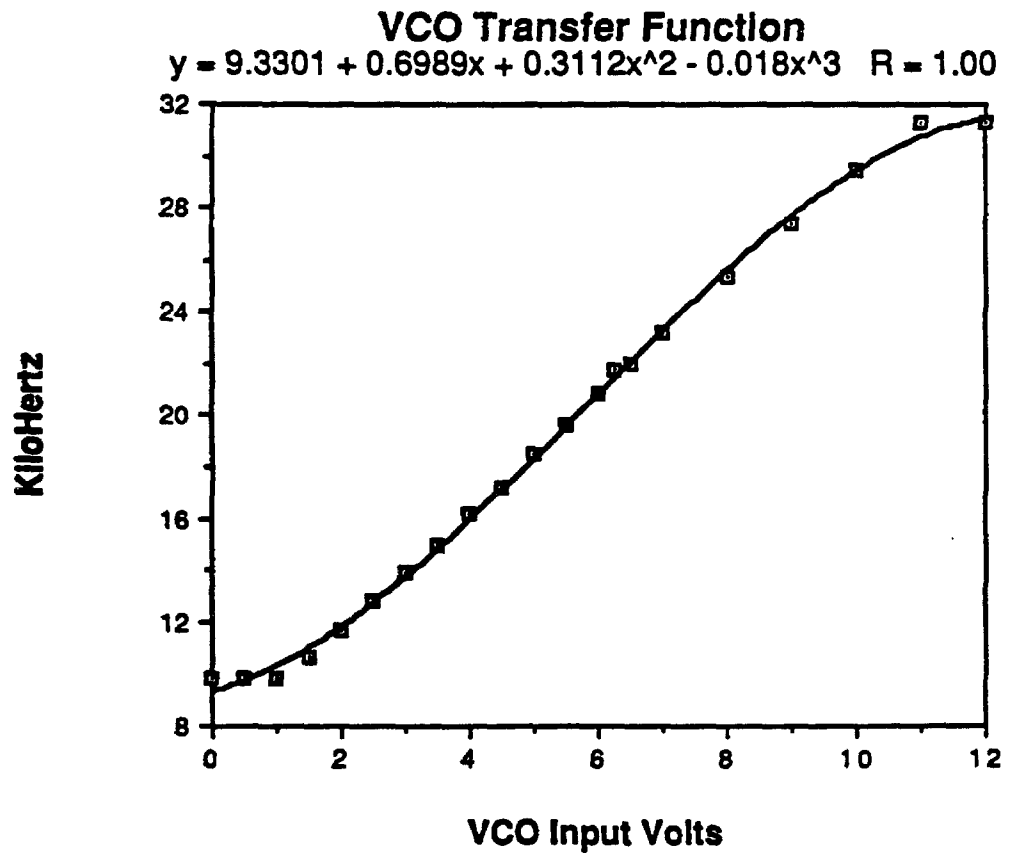
Figure d.
Two bifurcations. More frequencies appear.




Low Pass Filter Response
Peak Output Voltage
Peak Input Voltage
KiloHertz
5
4
3
2
1
0
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32


VCO Transfer Function
y = 9.3301 + 0.6989x + 0.3112x^2 - 0.018x^3 R = 1.00
KiloHertz
VCO Input Volts
32
28
24
20
16
12
8
0 2 4 6 8 10 12