Novel alternate mixed-mode chaotic circuit models for secure communication

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Abstract---In this paper we explore alternative models to implement the nonautonomous as well as autonomous chaotic dynamics in mixed-mode chaotic circuits. The parallel LC circuit based MMCC model and Wien bridge oscillator based MMCC model are presented alongwith their Pspice simulations to verify their mixed mode chaotic behaviour. Virtual simulations of alternative implementations of mixed-mode chaotic circuit were found satisfactory and successful .

Keywords:- Chaos, chaotic oscillator, mixed-mode chaotic circuit, Parallel LC circuit, Wien bridge circuit, secure communication.

I. INTRODUCTION

The first mixed-mode chaotic circuit was proposed by Recai Kilic et al in 2000 [1] which is a combination of both an autonomous chaotic Chua's circuit and a nonautonomous chaotic MLC circuit developed by Murali et al in 1994 [9]. It is able to provide greater realiability in the form of a wide range of parameter variations and extra security keys. Since then various improved realisations of MMCC have been presented [2,3,4] including circuits using CFOA's. Senani R and Gupta S S [8] have reported implementation of Chua's chaotic circuit using current feedback Op amps in 1998. Robust Op amp realisations of Chua's circuit was reported by Kenndy M P[10] in the year 1992. Recently MMCC circuits using quadrature core oscillators and blocks were reported by Klomkarn K and Sooraksa P [5,11] in the years 2010 -2011. Work on impulsive synchronization between two MMCC have also been reported by Recai Kilic [6, 7] in the years 2005 and 2006.

II. ALTERNATE REALISATIONS

(a)The parallel LC autonomous model

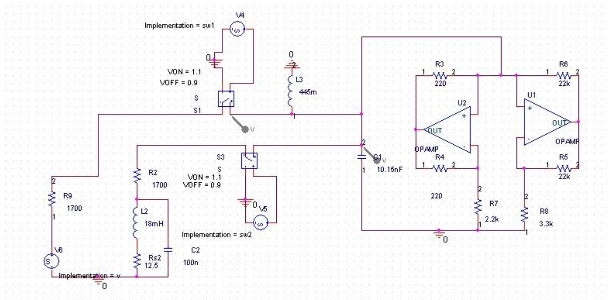

Figure 1 Parallel LC circuit based MMCC circuit

In this model, we have replaced the series LC combination in the non-autonomous mode with a parallel LC circuit as shown above in figure 1.

(b) Wien bridge oscillator based MMCC model

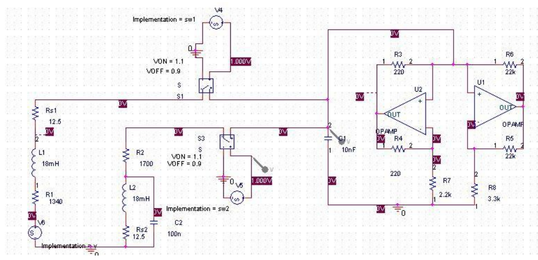

Fig. 2 Wien bridge oscillator based MMC Model.

In this model, we have replaced the original autonomous part with a Wien Bridge Oscillator based implementation. Theoretically a gain of 3 would be required to start the oscillations. In our circuit, we have implemented a slightly higher gain, that is, a gain of 3.1.

III CONCLUSIONS

Virtual simulations of alternative implementations of the mixed-mode circuit were successful and satisfactory. As can be seen from the transient analysis of capacitor voltage, we see how the circuits jump to and fro the non-autonomous and the autonomous mode of operation. The first model clearly exhibits the characteristics of a parallel LC circuit along with the dynamics due to the autonomous mode. The resultant chaos was satisfactory. The Wien Bridge Oscillator based model was simulated and the resulting plot showed double scroll attractor characteristic.

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