Dynamics in Electrical Systems

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***Abstract*—The abstract goes here.**

***Index Terms*—differential, dynamics, electrical, equation, modeling, ordinary, system**

I. Introduction

THIS this paper is intended to sum up the research done in order to understand the Dynamics in electrical systems and their underlying differential equations.

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II. Dynamical System

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III. Differential Equations

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A. Slope field

In *mathematics*, a **slope field** (or **direction field**) is a graphical representation of the solutions of a first-order differential equation. It is useful because it can be created without solving the differential equation analytically. The representation may be used to qualitatively visualize solutions, or to numerically approximate them [1].

IV. Limit Cycle

A **limit cycle** is an isolated closed trajectory. *Isolated* means that neighboring trajectories are not closed - they spiral either towards or away from the limit cycle.

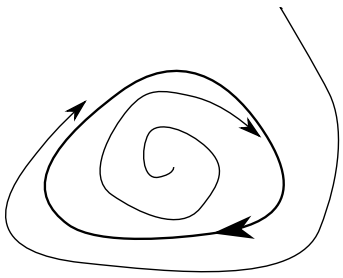

Fig. 1. Stable limit cycle. Trajectories spiral towards it.

If all neighboring trajectories approach the limit cycle, we say the limit cycle is stable or attracting. Otherwise the limit cycle is unstable, or in exceptional cases, half-stable. Stable limit cycles are very important scientifically they model systems that exhibit self-sustained oscillations. In other words, these systems oscillate even in the absence of external periodic forcing. Of the countless examples that could be given, we mention only a few: the beating of a heart; the periodic ring of a pace maker neuron; daily rhythms in human body temperature and hormone secretion; chemical reactions that oscillate spontaneously; and dangerous self-excited vibrations in bridges and airplane wings. In each case, there is a standard oscillation of some preferred period, waveform, and amplitude. If the system is perturbed slightly, it always returns to the standard cycle. Limit cycles are inherently nonlinear phenomena; they cant occur in linear systems [2].

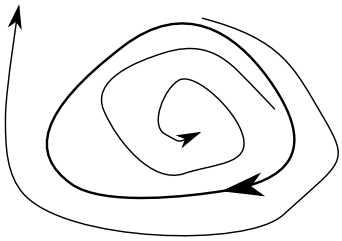

Fig. 2. Unstable limit cycle. Trajectories spiral away from it.

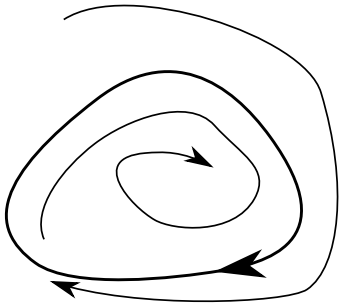

Fig. 3. Half-stable (or semi-stable) limit cycle. Attract trajectories from one side and repel them from other side.

V. Conclusion

The conclusion goes here.

Appendix A
Proof of the First Zonklar Equation

Appendix one text goes here.

Appendix B

Appendix two text goes here.

ACKNOWLEDGMENT

The authors would like to thank...

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[2] S.H. Strogatz. *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering*. Studies in nonlinearity. Westview Press, 2008. ISBN: 9780786723959.