Analytical, numerical and experimental analysis of a self-excited oscillator

J P Dada *et al* 2006 *Phys. Scr.* **74** 618-628 doi:10.1088/0031-8949/74/6/004

J P Dada[1], J C Chedjou[2], S Domngang[1] and K Kyamakya[3]

[1] Department of Physics, Faculty of Science, University of Yaoundé-I, PO Box 812, Yaoundé, Cameroon

[2] Department of Physics, Faculty of Science, University of Dschang, PO Box 67, Dschang, Cameroon

[3] Institut für Allgemeine Nachrichtentechnik, Universität Hannover, Appelstraße 9A, 30167, Hannover, Germany

Abstract. This paper studies the dynamics of a self-excited oscillator with two external periodic forces. Both the nonresonant and resonant states of the oscillator are considered. The hysteresis boundaries are derived and the hysteresis domains are defined in terms of the system parameters. Making use of the properties of Hill's equation, we derive the stability conditions of oscillation in the resonant case. Phase portraits are obtained numerically and experimentally. One of the most important contributions of this study is to validate a set of reliable analytical expressions (formulae) describing the system behaviour. These are of great importance for design engineers. The reliability of the analytical formulae is demonstrated by the very good agreement between the results obtained by numerical and experimental analyses.

PACS number: 05.45.-a

Print publication: Issue 6 (December 2006)
Received 17 August 2005, accepted for publication 1 September 2006
Published 31 October 2006