

- 4- Dalia Yousri, Dalia Allam, M.B. Eteiba. “Chaotic whale optimizer variants for parameters estimation of the chaotic behavior in Permanent Magnet Synchronous Motor”. Elsevier, Applied Soft Computing Journal 74 (2019) 479–503

Abstract

Permanent Magnet Synchronous Motor (PMSM) is widely used in the industrial applications because of its simple construction and its high efficiency. Unfortunately, if a small change has occurred in the system parameters, the PMSM displays an unexpected performance which is known as a chaotic behavior. To control this undesirable behavior, it is crucial to propose a robust tool to extract the model parameters accurately and rapidly. In this work, novel developed optimization techniques called Chaotic Whale Optimization variants (CWOA) are proposed where the standard Whale Optimization Algorithm (WOA) is integrated with different ten chaos maps to tune some of its parameters. Four CWOA variants are introduced, tested and validated mathematically over CEC 2017. In addition, CWOA variants and the standard WOA version are proposed to estimate the parameters of the chaotic behavior in PMSM at both of the off-line and the on-line operating conditions without and with noise. The results of the proposed algorithms are compared with that of the previous techniques in literature to test their efficiency, reliability, and accuracy. An intensive statistical analysis is accomplished for extra validation of the superiority of the proposed variants. The overall results indicate that the CWOA-II variant with the logistic chaos map offers the best performance among all other variants where it provides lower error values between the estimated and the original system performance, higher convergence speed and shorter execution time. This eventually helps to provide an accurate and fast description of the chaotic region to ensure a fast control of the motor as well as a fast protection from damage.