

Dynamic Analysis of Synchronous Motor Using Vector Diagrams—An Intuitive Approach

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Abstract—Vector diagrams have been used for many years to help understand the physical behavior of electric machines and to give geometrical answers to a number of machine operating problems. Vector diagrams for a synchronous machine in steady operational conditions or even at the first instant of a transient state are a quite common means of analyzing the machine performance. This paper shows the application of vector diagrams to represent the behavior of a synchronous motor *during* a transient process. As an example, the dynamic power diagram is introduced, showing the oscillation of the rotor following a sudden change in the motor operation. The intention of the paper is also to point out the contribution of the intuitive mind to the solution of technical problems, usually neglected in our educational system. It is the author's belief that the visualization obtained from geometric constructions is particularly useful for teaching purposes, since nowadays, the widespread use of computers to solve numerically the machine equations tends to divert the student's attention from the actual physical phenomenon occurring during the performance of the electrical machines.

Index Terms—Modeling, synchronous motor, vector diagrams.