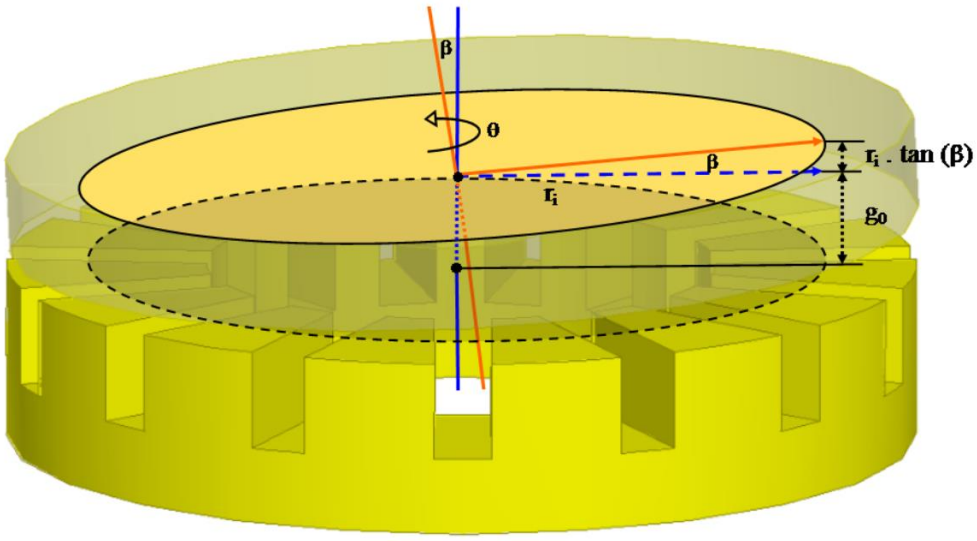
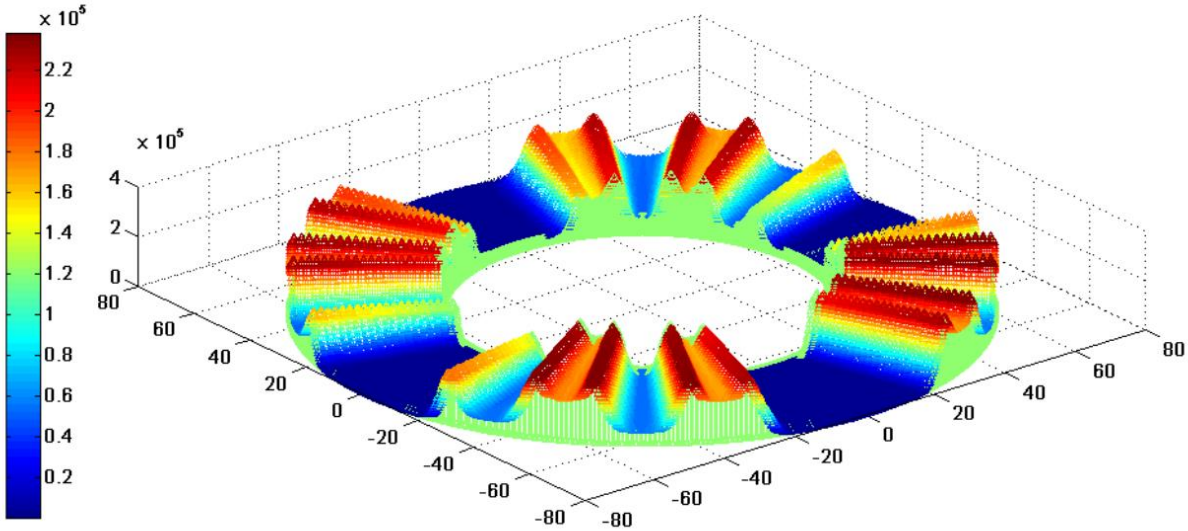
Modelling and Simulating the Unbalanced Magnetic pull in an Axial Flux PM Machine with static eccentricity fault

Since the 80's when for the first time high energy permanent magnet materials had been presented for using in permanent magnet synchronous machines, until now this machines have been significantly improved. In the last decade axial-flux permanent magnet machines have also been under research interest for specific applications such as electrical vehicles, electrical elevation and traction, etc. particularly due to special-application with limited geometrical considerations. On the other hand, faults always have been a part of electrical machines. So, it is important to model, predict and diagnose faults. This thesis concentrates on a specific kind of faults in machines that called eccentricity. Eccentricity faults are one of the mechanical faults of electrical machines and are vastly occurs in different kind of electrical machines from large ones to small ones. Studying this fault and unbalanced magnetic pull have a long history in scientific literature, however most of this papers are concentrating on radial flux machines and number of papers about eccentricity in axial flux permanent magnet machines don't exceed the number of one hands fingers. Duo to their specific structure and their 3D geometry modeling axial flux permanent magnet machines requires a method that can model the machine in three dimension. In this thesis using an analytical quasi 3D method an axial flux permanent machine was simulated and eccentricity fault effects on air-gap flux density, force distribution, no load voltage, etc. was presented. It was shown that given results is accurate and also has a high speed computation time compare to 3D finite element method. Also, the given results was verified by experimental results.

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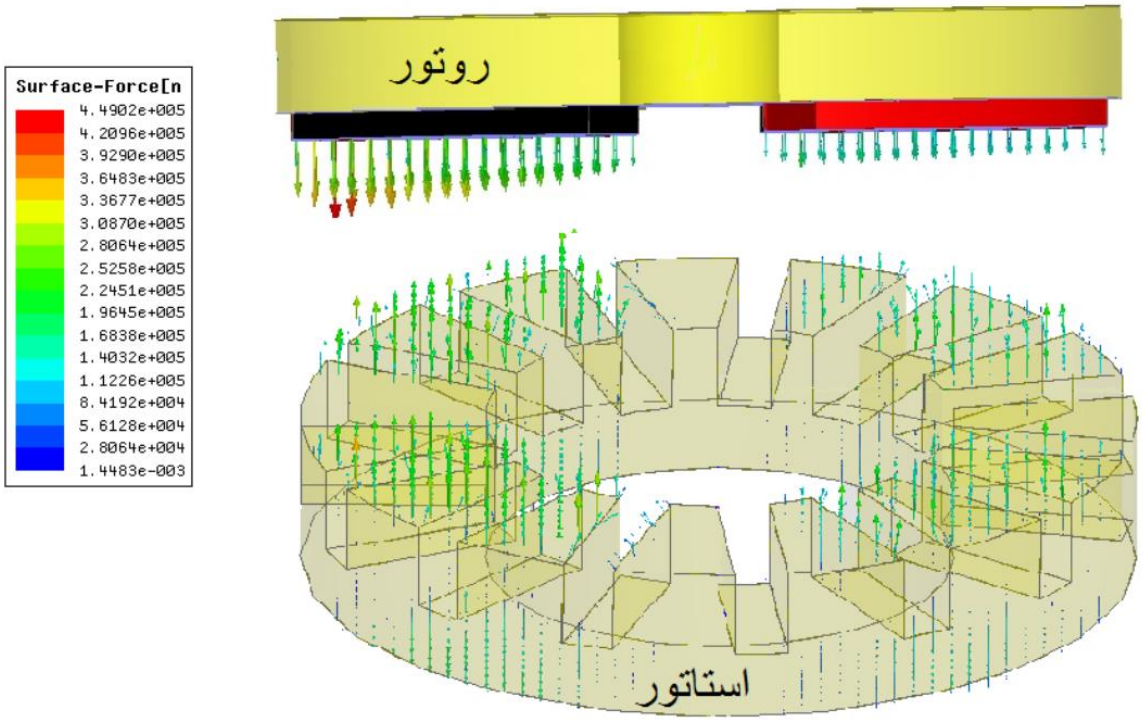
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