Estimation of Fourier Coefficients of Flux Density for Surface Mounted Permanent Magnet (SMPM) Generators by Direct Search Optimization

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Abstract : It is essential for Surface Mounted Permanent Magnet (SMPM) generators to determine the performance prediction and analyze the magnet's air gap flux density wave shape. The flux density wave shape is neither a pure sine wave or square wave nor a combination. This is due to the variation of air gap reluctance between the stator and permanent magnets. The stator slot openings and the number of slots make the wave shape highly complicated. To reduce the complexity of analysis, approximations are made to the wave shape using Fourier analysis. In contrast to the traditional integration method, the Fourier coefficients, an and bn, are obtained by direct search method optimization. The wave shape with optimized coefficients gives a wave shape close to the desired wave shape. Harmonics amplitudes are worked out and compared with initial values. It can be concluded that the direct search method can be used for estimating Fourier coefficients for irregular wave shapes.

Keywords : direct search, flux plot, fourier analysis, permanent magnets
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