

In this paper, a design methodology for surface permanent magnet (PM) synchronous machines, with special application to the case of high-speed machines, will be presented. Following a discussion of the principle and assumptions inherent in the methodology, the analytical model used in the study will be presented. This model will then be implemented to solve the problem of maximizing the power-to-volume ratio from an analytical perspective. It will be shown how this formulation serves to establish design rules, in addition to setting criteria values for the selection of magnetic materials (i.e., silicon steel sheet versus a soft magnetic material). At last, the paper will present a data test bench made of two PM machines designed since the methodology presented herein.