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Optimal Design of Air-Core Superconducting Generator Using Simplex Method

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Superconducting(SC) machines have been proposed and demonstrated for several high-power-density applications such as wind turbines, electric aircraft, and ship propulsion by using superconducting wires that can carry more than 100 times the current of conventional copper conductors [1][2]. Especially, fully air-core SC topologies have been considered as an option to achieve very high power density with unit weight of machines. In this paper, 10-MW 3000-rpm class active shield SC-generator which consists of rotating armature is proposed. Fig. 1 shows 1-pole analysis model with key parameters. Simplex method is useful optimization technique for finding the minimum or maximum value of the objective function by using reflection, contraction, and expansion. Fig. 2 shows the simplex method briefly. Initial simplex is formed of point 1, 2, 3. By comparing the objective function values at the points of the simplex, one of them (for example point 1) is reflected to point 4. Now 2nd simplex consists of point 2, 3, 4. It moves to the simplex having the optimal point gradually. In the full paper, the optimal design results by using Simplex method will be presented in detail.
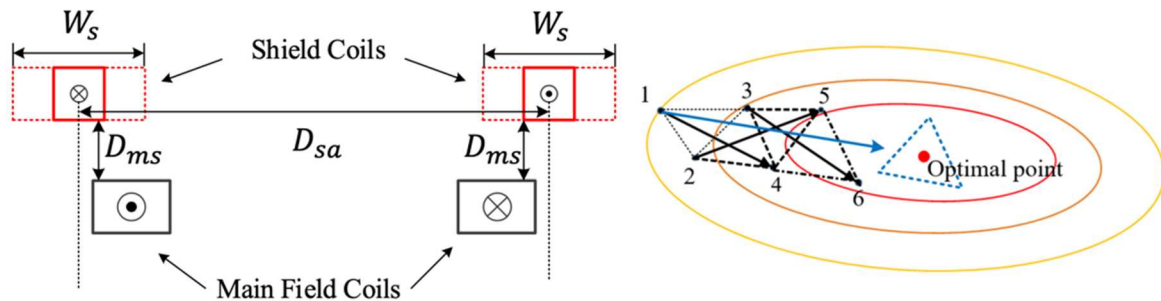
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