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ABSTRACTS

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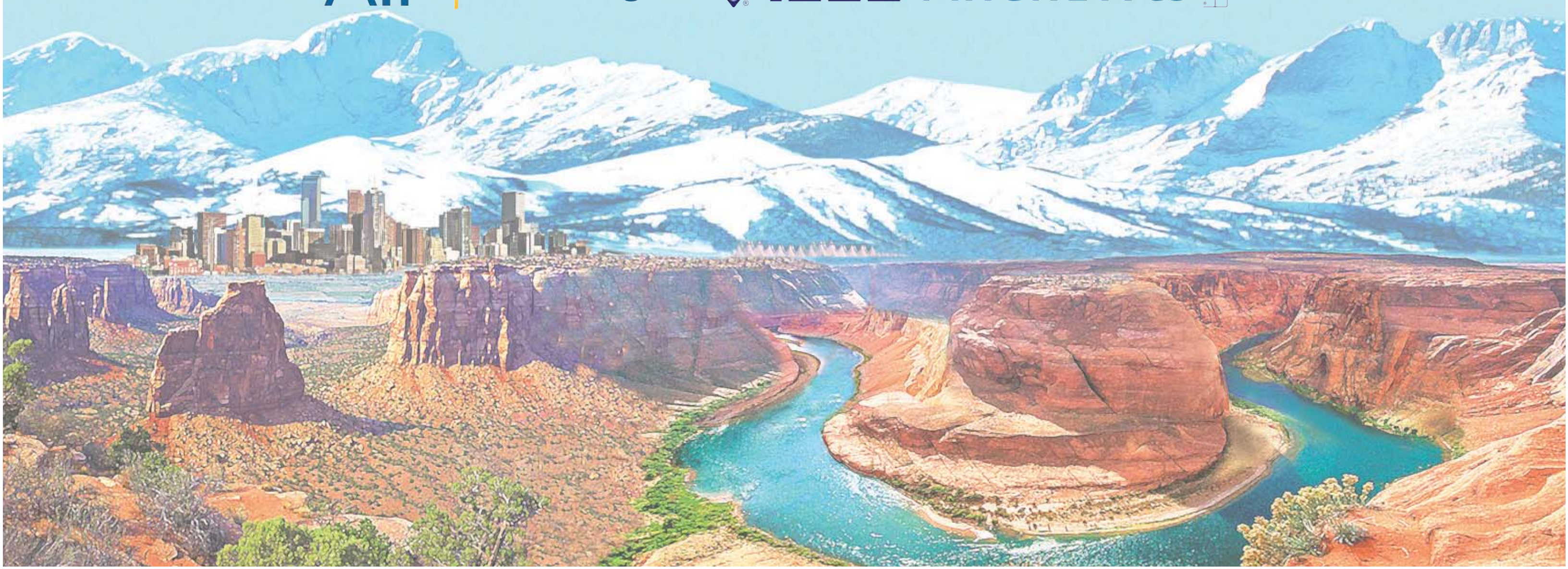

BQ-11. A simplified model of ferromagnetic sheets considering the magnetization dynamics utilizing the saturation wave model. *S. Steentjes*[1], S. Zirka[2], Y. Moroz[2], E. Moroz[2] and K. Hameyer[1] *1. Institute for Electrical Machines, RWTH Aachen University, Aachen, Germany; 2. Dnepropetrovsk National University, Dnepropetrovsk, Ukraine*

Consideration of magnetic hysteresis, eddy currents and so-called excess (anomalous) loss, which is caused by the domain structure of ferromagnetic materials [1], is essential for the accurate description of transformers, rotating electrical machines and other devices containing ferromagnetic cores. The ideal solution of such a problem would be a model, which allows predicting both, the specific loss and the shape of the hysteresis loop, i.e. the magnetization behavior, at arbitrary magnetization regimes. Utilizing a magneto-dynamic model (MDM) as in Ref. [2] enables a sufficiently accurate description of transients in the laminated non-oriented (NO) steel. However, when analyzing devices with branched magnetic topology, the dimension of the problem increases proportionally to the number of branches leading to a quite complicated and time-consuming model. Substantial simplifications of the problem, while keeping sufficiently accurate solution, can be achieved using a thin sheet model (TSM), which links the magnetic field on the sheet surface $H(t)$ and the mean magnetic flux density $B(t)$ over its cross section [1, 3, 4]. The magnetic field $H(t)$ in such a model is represented by the sum of hysteresis, eddy-current (classical) and excess components, $H(t) = H_h+H_{clas}+H_{exc}$. However, the shortcoming of this approach lies in the fact, that the usual skin effect observed in a magnetically linear medium is absent here, leading to wrong predictions of the eddy current field using the classical approach. For this reason, this paper proposes a TSM, improving the eddy current field description based upon physical ideas in the framework of the saturation wave model (SWM) [5]. In order to represent the layer-to-layer nature of the magnetization reversal, the classical eddy current component is replaced by the expression arising from the SWM. The hysteresis component is modeled by means of the static history-dependent hysteresis model (SHM) [6]. The effectiveness of the proposed algorithm will be confirmed in the full paper by modeling two NO steels and GO steel. Furthermore the model's ability to reproduce dynamic hysteresis loops at complex waveforms of the magnetization voltage will be stressed.

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