Application of extreme learning machine (elm) in paper insulation deterioration estimation of power transformer

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Power transformer is a key component in power system network. For proper and reliable operation, the health condition of power transformer should be maintained, which is affected due to deterioration of paper insulation. The healthy condition of oil-immersed transformer is decided as per the degree of deterioration of paper insulation of the winding (PIW). The dissolved gas in oil analysis (DGA) method is conventionally used to calculate the PIW deterioration status condition. This paper presented the four status conditions assessment of PIW deterioration for oil-immersed transformer using extreme learning machine (ELM). In this paper the correlation between accumulated values of carbon dioxide (CO₂) and carbon monoxide (CO) with insulation resistance in oil-filled power transformers is studied using ELM approach. The authors have estimated the PIW deterioration condition using proposed method for 50 transformers, as a result, appropriate maintenance scenario can be planned.

The proposed algorithm for paper insulation deterioration estimation of power transformer is shown in Figure 1 and its performance is presented in Table 1.

Table 1: ELM combination method classification performance

Multi-class ELM model performance	Mode of operation	MSE	RMS E	Accuracy (%)	Processing time (second)
	Training Phase	0.0058	0.1323	99.82	0.0347
	Testing Phase	0.009	0.0948	99.10	0.0235

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Figure 1: Proposed algorithm for power transformer paper insulation deterioration estimation