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Flank wear prediction in milling AISI 4140 based on cutting forces PCA for different cutting edge preparations

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Abstract: One of the criteria mastering the choice of a cutting tool is its wear resistance. For coated inserts, prior to the coating process, edge preparation method choice will impact their performance. So, a classification based on its impact on wear resistance is needed. Indeed, the flank wear of three coated cemented carbide inserts presenting differently prepared edges (untreated, dragging and magneto-abrasive machining) is explored experimentally. Those inserts are used to face mill the hardened AISI 4140 low alloy steel. Further, by means of the principal component analysis (PCA), correlations between the online measured cutting forces and flank wear behaviour are investigated. In view of this analysis, for each studied case, the statistical law predicting flank wear relying on cutting forces components is established with fair approximation. However, the experimental results have quantitatively shown that edge preparation could be in some cases not beneficial for tool wear resistance of the milling inserts considering either maximal or average flank wear.