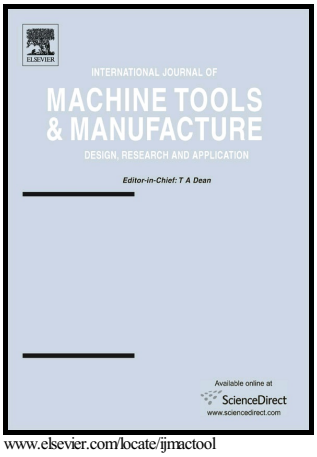

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A REVIEW OF HELICAL MILLING PROCESS

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Abstract

Helical milling is an alternative hole-making machining process which presents several advantages when compared to conventional drilling. In the helical milling process, the tool proceeds a helical path while rotates around its own axis. Due to its flexible kinematics, low cutting forces, tool wear, and improved borehole quality may be achieved. This paper presents a review of the helical milling process. As a first paper aiming to describe the current state of the art of helical milling process, the recent works about this process were summarized to point out the future trends in this field. Initially, the advantages of the helical milling were presented with regard to conventional drilling. Subsequently, the kinematics of the process was presented to standardize the nomenclature and to provide knowledge about the movements and parameters of helical milling. It was demonstrated the feed velocity decomposition in frontal and peripheral directions. Undeformed chip and cutting volumes of frontal and peripheral cut were described, and the ratio between the cutting volumes removed by frontal and peripheral cut was demonstrated to be dependent only of the borehole and tool diameters. Cutting forces and temperature studies were also summarized, corroborating that the helical milling is a smooth hole-making process. Afterward, tool life and wear studies in helical milling were summarized, testifying that the tool wear evolution can be monitored in frontal and peripheral cutting edges, with frontal cutting edges, in most cases, defining the tool life. Some statistical and soft computing applications on helical milling were also mentioned. To provide initial guidelines for applying helical milling, a screening of the current literature was performed summarizing equipment and cooling techniques used, and the levels of cutting conditions of helical milling applied for hole-making different materials. The quality of boreholes obtained by helical milling was assessed in terms of dimensional, geometrical, and microgeometrical deviations, besides burr and delamination levels, assuring that it can be obtained finished boreholes with helical milling. In the conclusions, future possibilities on research about helical milling were pointed out. This general review of helical milling may be referenced as a summary of the current results obtained in experimental and theoretical studies and to provide future research needs and opportunities.

Keyworks: Helical milling, orbital drilling, hole-making, borehole quality.