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Numerical investigations of optimum turning parameters—AA2024-T351 aluminum alloy
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Abstract
Aerospace aluminum alloys have gained the prime significance due to their excellent machining characteristics. Numerous experimental and numerical studies have been conducted to establish the optimum cutting parameters of these alloys. In the numerical cutting models, the authenticity of computational results is suspected particularly because of the complex interaction at tool–chip interface, which involves a high material strain rate and thermal processes. The fidelity of cutting simulation results is appraised by a parametric sensitivity analysis and actual experimentation. In this research, the orthogonal turning of AA2024-T351 aluminum is simulated in Abaqus/Explicit by using a thermoviscoplastic damage model and Coulomb friction model for the contact interfaces. A parametric sensitivity analysis is performed to comprehend the chip morphology, tool–chip interface temperature, reaction force, and strain. Different simulations are performed with varied cutting speeds (200, 400, 600, and 800 m/min), rake angles (5°, 10°, 14.8°, 17.5°), feeds (0.3, 0.4 mm), and friction coefficients (0.1, 0.15). It is observed that an increased rake angle decreases the cutting force and increases tool–chip interface temperature. Similarly, the cutting depth has prominent effect on chip–tool interface temperature as compared to the friction. The computational results are found in close approximation with the published experimental data of AA2024-T351. © 2016 Taylor & Francis Group, LLC.

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