FEM-SUPPORTED SIMULATION OF CHIP FORMATION AND FLOW IN GEAR HOBBING OF HELICAL GEARS

K.-D. Bouzakis, O. Friderikos
Laboratory for Machine Tools and Manufacturing Engineering, Mechanical Engineering Department, Aristotle University of Thessaloniki, Thessaloniki, 54124, Greece.
bouzakis@vergina.eng.auth.gr

Abstract

Based on an FEM supported modelling of the gear hobbing process, the four possible cutting variations in helical gear hobbing have been simulated. These variations are the up-cut equi-directional and counter-directional, as well as the climb equi-directional and counter-directional gear hobbing, considering the tool axial feed, the tool and the gear helix angle directions. The FEM implicit Lagrangian code (DEFORM 3D) was applied to simulate the previous kinematic variations, assuming constant the rest machining process data. Hereupon, modified material constitutive laws were applied, based on Oxley’s machining theory for steel AISI 1020. A direct comparison of the simulation results with experimental ones, concerning chip formation and cutting force components measurements has been conducted for the model validation. A significant insight of the complex chip formation and flow mechanism was provided, considering the different kinematics and penetrations between the tool and the gear blank. Moreover an improved description of the gear hobbing process has been obtained enabling the clarification of phenomena like the chip collision with gear flanks during the chip flow in individual generating positions, the wear development on certain edge locations etc.