İTÜ
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Virtual High Performance Machining

YUSUF ALTINTAŞ

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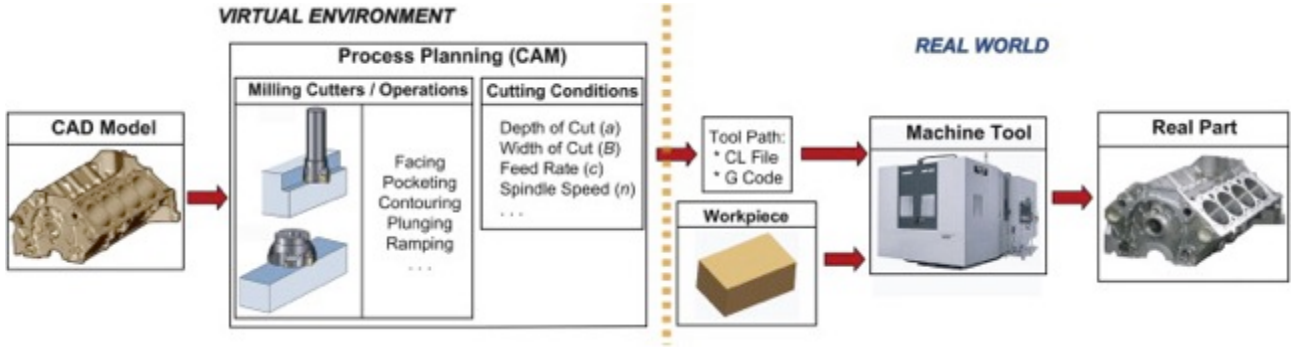
İTÜ Makina Fakültesi, Mavi Salon, Gümüşsuyu
http://www.mkn.itu.edu.tr/live (Canlı Yayın)



The aim of our research is to develop mathematical models of metal cutting operations, machine tool vibrations and control. The science based digital models allow the virtual design of machine tools, and testing and optimization of machining operations.

The model predicts the cutting forces, torque and power consumed in machining parts by considering material properties, cutter geometry, structural flexibilities, and cutting conditions along the tool path. The structural dynamics of the machine tool can either be imported from Finite Element analysis if the machine tool is at the design stage, or from the experimental modal measurements if the machine is already built. The simulation system predicts chatter free cutting conditions within the work volume of the machine tool, or detects the presence of chatter vibrations along the tool path. The dynamics of servo drive control systems, and trajectory generation as a function of jerk, acceleration and velocity profiles of machine tools are considered in simulating the machine tool behavior. An in-house developed virtual and real time CNC system allows the design and analysis of any five axis machine tool controller. Current research includes digital twin approach, where virtual simulation and real time machine tool monitoring are integrated to achieve intelligent, self-adjusting machine tools.

The algorithms are published in open literature (Google Scholar h-78 with over 23000 citations), and packaged in industrial software tool box which can be used as a process planning tool by production engineers or as an analysis module by machine tool builders (over 250 companies and research centers world-wide).