A methodology for online visualization of the energy flow in a machine tool - DTU Orbit (21/12/2018)

A methodology for online visualization of the energy flow in a machine tool

The demand of energy efficient machine tools has increased recently due to the awareness for energy efficient production in precision manufacturing. A portion of the energy supplied to machine tools is transferred to thermal losses which influence also the thermal behavior of the precision related machine tools components. Machine cooling and process cooling can prevent thermal machine tool errors. However this further requires considerable amounts of energy. Hence there is a demand to monitor the electric, thermal, fluidic and mechanical energy flows in the machine tool in order to optimize the machining process and by this increasing its energy efficiency. This study intents to propose a method which has the capability of real-time monitoring of the entire energetic flows in a CNC machine tool including motors, pumps and cooling fluid. The structure of this approach is based on categorizing the machine into subsystems and measurements of the consumers (pump, motors, . . .) power, temperature at the inlet and outlet of the pumps and current as well as the speed of the motors. The visualization is carried out by a 2D Sankey diagram, which makes it easy to understand the energetic flows in the machine tool. The methodology is verified by the rule of energy conversion which confirms the capability of this method on real-time energy monitoring of a machine tool.

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