

**Dissertation title:**

**Machine Learning Model for Process Interaction during Wood Milling on the Basis of Online-captured Tool Machine Data**

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The increasing global competition forces manufacturing companies to be more and more efficient and utilize remaining capabilities. In the furniture manufacturing industry, one of the main processes is milling. In the operational planning of tool usage during the milling process, there's lots of room for improvement in efficiency. Well planned tool usage is the prerequisite for high equipment utilization. Current industry trends in furniture manufacturing are mass customization, smaller lot sizes, individualized furniture and new cutting materials. These trends pose enormous challenges when it comes to precise planning and scheduling of cutting tool usage due to the fact that each cutting material and raw material combination comes with different abrasive wear characteristics. The goal of this thesis is to capture and evaluate the tool usage data to monitor the operation in a traceable manner. To achieve this goal, a model for online-capturing and evaluation was established. This model combines machine tool control data and context information about the specific tool used as well as the production order information such as raw material type. Using this information, a toolspecific operation history is generated. The resulting history data, combined with actual physical measurements, is the basis for the learning step which establishes wear factors for each combination of raw material and cutting material. The wear factors are used to predict the remaining tool life and determine the ideal too replacement window between two production orders. To proof the model's consistency, it was implemented and the operational capability was tested by performing various trial runs to determine the interaction of the process features and the process outcome for one specific raw material and cutting material combination. This interaction are quantified in a set of wear and quality prognosis coefficients.