

Preface

Machining dynamics is a very old topic on manufacturing processes with consideration of cutting interruption, intermittency, and the coupled interaction between the tool- and work-piece for a better understanding of the underlying physics dictating material removal. In this book, cutting is treated as a nonsmooth system composed of three continuous dynamical subsystems. The corresponding boundaries are (1) the tool- and work-piece contact/impact boundary, (2) the onset/disappearance of cutting boundary, (3) the chip/tool friction boundary, and (4) the chip vanishing boundary. The complex motions in cutting dynamics are mainly caused by discontinuities, including *chip and tool-piece seizure* and complex *stick-slip motion*. Through the application of discontinuous system theory, a comprehensive understanding of the grazing phenomena induced by the frictional-velocity boundary and the loss of contact between the tool- and work-piece are discussed. Significant insights are to control machine-tool vibration and to develop chatter-free machine-tool concept.

The coupling, interaction, and evolution of different cutting states to mitigate machining instability and to enable better machine-tool design are addressed in this book. The monograph presents a sound foundation upon which engineering professionals, practicing and in-training alike, could explore with rigor to make advance in manufacturing, machine-tool design, and machining chatter control. Research professionals in the general areas of nonlinear dynamics and nonlinear control would also find the volume informative in qualitative and quantitative terms as to how semistable interrupted periodic motions lead to unstable motions.

The research and endeavor needed for the creation of *Machine Tool Vibrations and Cutting Dynamics* necessarily put a burden on family life. Without the unwavering support of our families, the completion of the book would not have been possible. Our sincere gratitude also goes to our editor at Springer Science, Steven Elliot, for his professionalism and encouragement, and to the institutions we are associated with for the collegiate support.

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