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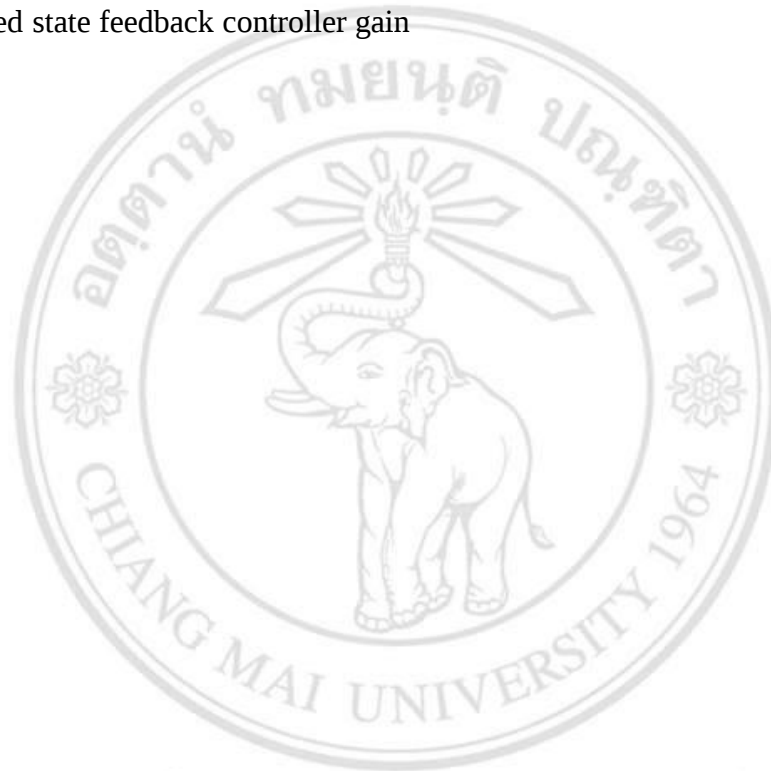
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LIST OF ABBREVIATIONS AND SYMBOLS

τ	Time-delay
b_K	Depth-of-cut parameter
$b_{K,\max}$	Maximum stable depth-of-cut parameter
Ω	Tool rotational speed
h_m	Zero vibration mean chip thickness
$h(t)$	Instantaneous mean chip thickness
f	Linear feed rate of the workpiece to the cutting tool
f_t	Feed per tooth
ϕ	Instantaneous cutting tool's rotational angle
u	Designed Control force
w	Cutting force
w_0	Zero vibration cutting force
x	System state vectors
x_r	Weighting function state vector
$\tilde{x}$	Augmented system state vector
x_{cl}	Closed-loop system state vector
y_m	Output measurement signals
y_a	Displacement signals of a control actuator
y_t	Displacement signals of a cutting actuator
ε	Strain signals
ω_c	Chatter frequency
ω_n	Flexible structure natural frequency
λ	Eigenvalues
T	Transformation matrix
Δ_a	Additive uncertainty

Δ_m	Multiplicative uncertainty
W_r	Weighting function
K_p	Proportional feedback gain of PD controller
K_D	Derivative feedback gain of PD controller
K	State feedback controller gain
K_0	Current state feedback controller gain
K_τ	Delayed state feedback controller gain



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ข้อความแห่งการริเริ่ม

- 1) การออกแบบตัวควบคุมที่เหมาะสมแบบใหม่สำหรับการควบคุมแบบแอ็กทิฟเพื่อควบคุมเสถียรภาพของการสั่นที่เกิดจากระบบการขึ้นรูปชิ้นงานภายใต้แบบจำลองของระบบหน่วงเวลา แง่มุมใหม่ที่ได้คือการสร้างเกณฑ์เสถียรภาพแบบโรบัสต์ภายใต้ฟังก์ชันนัลของเลอปูนอฟ-คราซอฟสกี ซึ่งนำไปสู่เงื่อนไขของอสมการเมทริกซ์เชิงเส้น ที่สามารถสังเคราะห์ตัวควบคุมแบบสัญญาณป้อนกลับ วิธีการออกแบบตัวควบคุมยังมีการใช้เงื่อนไขความโรบัสต์ของความคลาดเคลื่อนของแบบจำลองในช่วงของโครงสร้างพลศาสตร์ที่ย่านความถี่สูง ซึ่งถูกพิจารณาให้เป็นความไม่แน่นอนเชิงโดเมนความถี่โดยผ่านพลศาสตร์ส่วนเพิ่มเติม ถึงแม้ว่าเทคนิคเหล่านี้จะเคยมีการประยุกต์ใช้โดยแยกกันในงานวิจัยที่มีมาก่อนหน้านี้ แต่การใช้งานที่มีการรวมเทคนิคดังกล่าวเพื่อมาประยุกต์ใช้กับพลศาสตร์ของกระบวนการขึ้นรูปจริงยังคงเป็นสิ่งที่ใหม่ที่ยังไม่มีการศึกษามาก่อน
- 2) แทนทดสอบการกักขังรูปแบบใหม่ได้ถูกออกแบบสำหรับใช้ทดสอบตัวควบคุมแบบแอ็กทิฟ แทนทดสอบถูกออกแบบภายใต้แบบจำลองพื้นฐานของโครงสร้างยึดหยุ่นของสปริงเดิลและดอกกักขังงาน และสามารถวัดข้อมูลได้อย่างครบถ้วนโดยผ่านเซนเซอร์ที่ถูกติดตั้งบนแท่นตัวกระตุ้นแม่เหล็กไฟฟ้าถูกใช้เพื่อจำลองผลของการกักขังงานตามสมการพลศาสตร์ของการกักขังงานที่ถูกกำหนด โดยการใช้ฮาร์ดแวร์ควบคุมเวลาทันที (real-time control hardware)

STATEMENT OF ORIGINALITY

- 1) New optimized controller designs for active control of vibrational stability in machining processes based on linear time delay system models are proposed. The main novel aspect is the formulation of robust stability criterion based on Lyapunov Krasovskii functionals that lead to Linear Matrix Inequality conditions that can be used to synthesize feedback controllers. The controller design approach incorporates a robustness criterion where model error associated with high frequency structural dynamics is accounted for by a frequency domain uncertainty representation via augmented dynamics. Although similar techniques have been used separately in previous work by other researchers, their combined use and application to realistic machining dynamics is believed to be novel.
- 2) A new test facility has been designed and realized for the experiments on active control of machining vibration. This test system involves a simplified representation of a flexible milling spindle/tool structure that allows full monitoring via multiple sensor integration. An electromagnetic actuator can be used to emulate cutting effects according to any given cutting dynamics equations which are implemented by real-time control hardware.

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