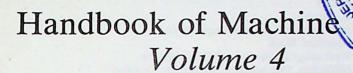
R 621.9'02 Wec



Metrological Analysis and Performance Tests

Manfred Weck

Lehrstuhl für Werkzeugmaschinen Laboratorium für Werkzeugmaschinen und Betriebslehre Aachen, Germany

Translated from the original German by

H. BIBRING

Senior Lecturer, Middlesex Polytechnic

London, U.K.

3969/7212.

A Wiley Heyden Publication

CONTENTS

Fo	rewor	d .			ix				
Pr	eface				xi				
No	menc	lature a	and Abbreviations		xiii				
1	Aims and Methods for Determining the Variables								
	Dire	ct Meas	urement and Appraisal of Machine Characteristics		7				
2	Geor	netric a	nd Kinematic Behaviour of Machines		9				
	2.1	Geom	etric deviations		9				
		2.1.1	General description of periodic or constant deflection	ns					
			and errors		10				
			2.1.1.1 Movement along one axis		10				
			2.1.1.2 Movement along several axes		13				
		2.1.2	General description of the random contributions to						
			the deflections		15				
		2.1.3	Determination of workpiece dimensional errors due						
			to the geometric machine deflections	-	16				
		2.1.4	Linear treatment of deflections		17				
		2.1.5	Metrological techniques to determine geometric						
			characteristics of machines		21				
			2.1.5.1 Measurement of straightness errors .		23				
			2.1.5.2 Measurement of positional errors .		26				
			2.1.5.3 Measurement of angular and rotary errors		31				
			2.1.5.4 Measurement of the relative motion of the						
			axis of rotation (radial motion errors)		32				
			2.1.5.5 Geometric measurement between pairs of						
			machine axes		33				
	2.2	Kinen	natic errors		35				
		2.2.1	General description		35				
		2.2.2	Inspection techniques to determine kinematic machi	ine					
			characteristics		36				
			2.2.2.1 Measurement of feed error (rotary/						
			translatory movement) on a lathe .		36				

			2.2.2.2	Measurement of rotation and feed mot							
				errors on a gear-hobbing machine (rota	ary/						
				rotary/translatory motion)			38				
			2.2.2.3	Measurement of two NC axes (translat	ory/						
				translatory motion)			41				
3	The	rmal Ef	fects on M	Tachine Tools		•	43				
4	Stat	ic and I	Dynamic B	ehaviour of Machine Tools			46				
	4.1	Funda	amentals o	f dynamic behaviour	1		46				
		4.1.1	Determi	nation of system characteristics from							
			measure	ments of the dynamic flexibility condition	ns		49				
	4.2	Types	of vibrati	ons and their causes			51				
	4.3	Syster	Systematic description of the regenerative effect								
	4.4		ematic description of the regenerative effect								
	4.5			f elastic deformations	100		61				
		4.5.1	Measure	ment of static flexibility conditions .			62				
		4.5.2	Measure	ment of dynamic flexibility conditions .			64				
		4.5.3		exciters			67				
			4.5.3.1	Electrodynamic exciters	disting.		68				
				Electrohydraulic relative exciters .			68				
				Electrohydraulic absolute exciters .			70				
				Electromagnetic relative exciters .			70				
				Impulse hammers			71				
		4.5.4		easurement			73				
		4.5.5	Displace	ement, velocity and acceleration measure	men	t	73				
	4.6		sis technic				76				
				when using sinusoidal input signals .			76				
		4.6.2		when using stochastic and aperiodic inp	ut						
			signals .				78				
		4.6.3		on of interference signal effects			80				
	4.7			ation form or mode			85				
		4.7.1		alysis of vibrations under sinusoidal inp	ut						
			signals .				85				
		4.7.2		alysis of vibrations under stochastic and							
				c input signals			86				
	4.8	Measu		ducing chatter tendencies			88				
	4.9			exibility conditions; machining simulation	n		90				
				one on the contract of the con							
5	Noise Emission by Machine Tools										
	5.1			sound characteristics			97				
		5.1.1		ressure level and acoustic power level .		•	98				
				ound levels			100				
	5.3			me-dependent decaying noise			101				
		5.3.1	Permissi	bile effective times for sound pressure le	vel		101				

													VII
		5.3.2	Interm	ittent	noise	patte	rns—	equiva	alent	level			102
	5.4		al comp										103
	5.5		measur										105
			Measu										105
			Measu					lysis					106
	5.6		sions w						oise				107
	5.7		res for r										109
	5.8											of	
			hnique										115
		5.8.1	Descrip	otion o	of noi	se cha	racte	istics					118
		5.8.2	Curren	t state	of th	e tech	nolog	y		W. 1000	(120
	Indirect Measurement of the Evaluation Parameters by Performance												
	Tests										0.00		123
5	Worl	Accur.	acy (Ex	amina	tion o	f Mac	hined	Worl	cpiec	es)			125
	6.1		nent m					.000					126
		6.1.1	Inspect				and po	ositio	nal u	ncerta	inty		129
		6.1.2	Tests fe	or stat	ic stif	fness							134
7	Limit	ting Cut	tting Ca	pabili	ty (Dy	namio	Beha	viour	.)				135
3	Sum	nary		To par	*	. 13							139
and the first that there is not understand the control of the cont													
References											140		
nday													
n	IOV												1 40

UPT PERPUSTAKAAN UNIVERSITAS SRIWIJAYA

NO. DAFTAR :

92003047

TANGGAL

· 2 2 MAR 1992