

CONTENTS

Title Page	i
Certificate of Approval	ii
Certificate	iii
Declaration	iv
Acknowledgements	v
List of Symbols and Abbreviations	vi
Abstract	ix
Contents	x
Chapter 1 Introduction	1
1.1 Background and motivation	1
1.2. Contribution of the thesis	4
1.3. Organization of the thesis	6
Chapter 2 Literature Survey	9
2.1. Introduction	9
2.2. Machine vision in manufacturing	11
2.2.1 Direct TCM using machine vision	13
2.2.2 Indirect TCM using machine vision	17
2.2.2.1 Statistical texture analysis	19

2.2.2.2	Signal processing based texture analysis	22
2.2.2.3	Model based texture analysis	23
2.2.2.4	Geometrical texture analysis	23
2.2.2.5	Decision making phase	24
2.3	Objectives of the current research	26
2.4	Summary	28
Chapter 3	Theory of Texture Analyses and Support Vector Machine	30
3.1	Introduction	30
3.2	Image pre-processing	32
3.3	GLCM based texture analysis	33
3.4	VT based texture analysis	39
3.5	DWT based texture analysis	45
3.6	Support vector machine	55
3.6.1	Background	55
3.6.2	Theory	60
3.7	Summary	65
Chapter 4	Experimental Set-up	67
4.1	Introduction	67

4.2 Turning experiments	67
4.3 Image acquisition	69
4.3.1 Illumination system	69
4.3.2 Camera	71
4.3.3 Lens system	72
4.4 Summary	75
Chapter 5 Results and Discussion: Turning	76
5.1 Introduction	76
5.2 GLCM based texture analysis	80
5.2.1 Results of <i>CON</i>	80
5.2.2 Results of <i>SDM</i>	85
5.3 VT based texture analysis	88
5.3.1 Results of <i>NPZCM</i>	89
5.3.1 Results of <i>TAP</i>	92
5.4 DWT based texture analysis	95
5.4.1 Selection of mother wavelet and decomposition level	96
5.4.2 Results of <i>G_{RMS}</i>	103
5.4.3 Results of <i>ENE</i>	106
5.5 Support vector machine based regression	110
5.5.1 Selection of kernel	111

5.5.2 Results of prediction and model selection	112
5.5 Summary	116
Chapter 6 TCM of End Milling: A Special Study	118
6.1 Introduction	118
6.2 Experimental details	118
6.3 Results and discussion	124
6.3.1 Results with GLCM based texture analysis	124
6.3.2 Results with DWT based texture analysis	127
6.3.3 Results of prediction	130
6.4 Summary	133
Chapter 7 Conclusions	134
7.1 Conclusions from the present work	134
7.2 Direction towards future research	140
References	142
Author's Biography	155