

CHAPTER ONE: INTRODUCTION	1
STUDY GOALS AND OBJECTIVES	1
REASONS FOR DOING THE STUDY.....	2
REASONS FOR DOING THE STUDY (CONTINUED)	3
CONTRIBUTIONS OF THE STUDY AND FOR WHOM	4
SCOPE AND FORMAT.....	4
ROBOTS NOT INCLUDED IN THIS REPORT	5
INFORMATION SOURCES AND METHODOLOGY	5
RELATED BCC REPORTS.....	5
A NOTE TO PURCHASERS OF BCC'S 2003 ROBOTIC STUDY (ENG001A)	5
ANALYST CREDENTIALS	5
BCC ONLINE SERVICES	6
DISCLAIMER.....	6
CHAPTER TWO: SUMMARY	7
<i>SUMMARY TABLE WORLDWIDE DEMAND FOR ROBOTS, BY TYPE, THROUGH 2014 (\$ MILLIONS)</i>	8
<i>SUMMARY FIGURE WORLDWIDE DEMAND FOR ROBOTS, BY TYPE, 2007-2014 (\$ MILLIONS)</i>	8
CHAPTER THREE: A UNIQUE MACHINE.....	9
<i>TABLE 1 ROBOT HALL OF FAME INDUCTEES</i>	10
POPULAR VIEWS OF ROBOTS.....	11
PROFESSIONAL VIEWS OF ROBOTS.....	11
PROFESSIONAL VIEWS OF ROBOTS (CONTINUED)	12
DISTINCTION BETWEEN AUTOMATION AND ROBOTICS.....	13
DE FACTO U.S. DEFINITION OF A ROBOT	13
EVOLUTION OF A GLOBALLY HARMONIZED DEFINITION	13
Evolution of a Globally ...Continued).....	14
<i>TABLE 2 NATIONS SETTING THE ISO ROBOTIC STANDARDS (BY STATUS)</i>	15
<i>TABLE 2 (CONTINUED)</i>	16
CHAPTER FOUR: THE SIX BASIC TYPES OF ROBOTS.....	17
THE SIX BASIC TYPES OF ROBOTS (CONTINUED)	18
SIX TYPE DIVISION	19
<i>TABLE 3 GLOBAL DEMAND FOR ROBOTIC SYSTEMS, BY COMPONENT, THROUGH 2014 (\$ MILLIONS)</i>	20
<i>TABLE 3 (CONTINUED)</i>	21
<i>TABLE 4 GLOBAL DEMAND FOR ROBOTIC SYSTEMS, BY TYPE, THROUGH 2014 (\$ MILLIONS)</i>	21
<i>TABLE 5 NORTH AMERICAN DEMAND FOR ROBOTIC SYSTEMS, BY TYPE, THROUGH 2014 (\$ MILLIONS)</i>	22

<i>FIGURE 1 NORTH AMERICAN DEMAND FOR ROBOTIC SYSTEMS, BY TYPE, 2007-2014 (\$ MILLIONS)</i>	22
<i>TABLE 6 EUROPEAN UNION DEMAND FOR ROBOTIC SYSTEMS, BY TYPE THROUGH 2014 (\$ MILLIONS)</i>	23
<i>FIGURE 2 EUROPEAN UNION DEMAND FOR ROBOTIC SYSTEMS, BY TYPE, 2007-2014 (\$ MILLIONS)</i>	23
<i>TABLE 7 ASIAN DEMAND FOR ROBOTIC SYSTEMS, BY TYPE, THROUGH 2014 (\$ MILLIONS)</i>	24
<i>FIGURE 3 ASIAN DEMAND FOR ROBOTIC SYSTEMS, BY TYPE, 2007-2014 (\$ MILLIONS)</i>	24
<i>TABLE 8 REST OF THE WORLD'S DEMAND FOR ROBOTIC SYSTEMS, BY TYPE, THROUGH 2014 (\$ MILLIONS)</i>	25
<i>FIGURE 4 REST OF THE WORLD DEMAND FOR ROBOTIC SYSTEMS, BY TYPE, 2007-2014 (\$ MILLIONS)</i>	25
<i>DEMAND FOR WHOLE ROBOTS</i>	26
<i>TABLE 9 GLOBAL DEMAND FOR WHOLE INDUSTRIAL ROBOTS, BY SPECIALIZATION, THROUGH 2014 (\$ MILLIONS)</i>	26
<i>TABLE 10 GLOBAL DEMAND FOR WHOLE DOMESTIC SERVICE ROBOTS, BY SPECIALIZATION, THROUGH 2014 (\$ MILLIONS)</i>	26
<i>TABLE 11 GLOBAL DEMAND FOR WHOLE PROFESSIONAL SERVICE ROBOTS, BY SPECIALIZATION, THROUGH 2014 (\$ MILLIONS)</i>	27
<i>TABLE 12 GLOBAL DEMAND FOR WHOLE MILITARY ROBOTS, BY SPECIALIZATION, THROUGH 2014 (\$ MILLIONS)</i>	27
<i>TABLE 13 GLOBAL DEMAND FOR WHOLE SECURITY ROBOTS, BY SPECIALIZATION, THROUGH 2014 (\$ MILLIONS)</i>	28
<i>TABLE 14 GLOBAL DEMAND FOR WHOLE SPACE ROBOTS, BY SPECIALIZATION, THROUGH 2014 (\$ MILLIONS)</i>	28
<i>HARMONIZATION WITH THE 2003 BCC ROBOT STUDY (ENG001A)</i>	28
<i>TABLE 15 INDUSTRIAL ROBOT HARMONIZATION</i>	29
<i>TABLE 16 DOMESTIC SERVICE ROBOT HARMONIZATION</i>	30
<i>TABLE 17 PROFESSIONAL SERVICE ROBOT HARMONIZATION</i>	30
<i>TABLE 18 MILITARY ROBOT HARMONIZATION</i>	31
<i>TABLE 19 SECURITY ROBOT HARMONIZATION</i>	31
<i>TABLE 20 SPACE ROBOT HARMONIZATION</i>	31
<i>DEMAND FOR SPECIALIZED TYPES OF ROBOTS</i>	31
<i>INDUSTRIAL ROBOTS</i>	32
<i>TABLE 21 GLOBAL DEMAND FOR SPECIALIZED INDUSTRIAL ROBOTS, THROUGH 2014 (\$ MILLIONS)</i>	32
<i>DOMESTIC SERVICE ROBOTS</i>	32
<i>TABLE 22 GLOBAL DEMAND FOR SPECIALIZED DOMESTIC SERVICE ROBOTS, THROUGH 2014 (\$ MILLIONS)</i>	33
<i>PROFESSIONAL SERVICE ROBOTS</i>	33

<i>TABLE 23 GLOBAL DEMAND FOR SPECIALIZED PROFESSIONAL SERVICE ROBOTS, THROUGH 2014 (\$ MILLIONS)</i>	33
MILITARY ROBOTS	34
<i>TABLE 24 GLOBAL DEMAND FOR SPECIALIZED MILITARY ROBOTS, THROUGH 2014 (\$ MILLIONS)</i>	34
SECURITY ROBOTS	34
<i>TABLE 25 GLOBAL DEMAND FOR SPECIALIZED SECURITY ROBOTS, THROUGH 2014 (\$ MILLIONS)</i>	34
SPACE ROBOTS	35
<i>TABLE 26 GLOBAL DEMAND FOR SPACE ROBOTS, THROUGH 2014 (\$ MILLIONS)</i>	35
CHAPTER FIVE: ENABLING TECHNOLOGIES	36
TECHNOLOGIES	37
ACTUATION	37
ADAPTATION	37
AUTONOMY.....	38
CALIBRATION.....	39
COGNITION.....	39
COLLISION AVOIDANCE	39
CONFIGURATION.....	40
CONTROL.....	40
DEPENDABILITY.....	41
END EFFECTORS, GRIPPERS, AND DEXTEROUS HANDS.....	41
HUMAN-ROBOT INTERFACES	42
Human-Robot Interfaces (Continued)	43
KNOWLEDGE SYSTEMS	44
LEARNING.....	44
LOCALIZATION.....	45
LOCOMOTION.....	46
MANIPULATION.....	47
Manipulation (Continued)	48
MATERIALS.....	49
MECHATRONICS.....	50
<i>TABLE 27 MECHATRONICS EDUCATION PROGRAMS (BS, MS, CERTIFICATION OR COURSEWORK)</i>	51
MISSIONS, TASKS AND PROCESSES.....	51
MOTION CONTROL.....	51
NAVIGATION.....	52
Navigation (Continued)	53
PERCEPTION	54
POWER MANAGEMENT	54
ROBOT-ROBOT INTERACTION	55
ROBUSTNESS.....	56
SAFETY	56

<i>TABLE 28 GLOBAL SAFETY-RELATED EXPENDITURES FOR ROBOTS, THROUGH 2014 (\$ MILLIONS)</i>	57
<i>TABLE 28 (CONTINUED)</i>	58
SENSING	58
SENSORS	58
SENSOR FUSION	59
STANDARDIZATION	59
<i>TABLE 29 ISO TC 184/SC 2 ROBOTS AND ROBOTIC DEVICE STANDARDS (IN PLACE AS OF JAN 15, 2009, LISTED CHRONOLOGICALLY FROM OLDEST TO MOST RECENT)</i>	59
<i>TABLE 29 (CONTINUED)</i>	60
<i>TABLE 30 ISO TC 184/SC 2 ROBOTS AND ROBOTIC DEVICE STANDARDS AND PROJECTS UNDER PERIODIC REVIEW (IN PLACE AS OF JAN 15, 2009, LISTED CHRONOLOGICALLY FROM OLDEST TO MOST RECENT)</i>	60
<i>TABLE 31 WITHDRAWN ISO ROBOTS AND ROBOTIC DEVICE STANDARDS AND PROJECTS (IN PLACE AS OF JAN 15, 2009, LISTED CHRONOLOGICALLY FROM OLDEST TO MOST RECENT)</i>	60
<i>TABLE 31 (CONTINUED)</i>	61
<i>TABLE 32 ISO STANDARDS AND PROJECTS RELATED TO, BUT NOT CATEGORIZED AS, ROBOTS OR ROBOTIC DEVICES</i>	61
<i>TABLE 32 (CONTINUED)</i>	62
SWARMS AND NETWORKS.....	62
TELEPRESENCE AND TELEROBOTICS	63
VISION	63
Vision (Continued)	64
CHAPTER SIX: FACTORS INFLUENCING THE DEMAND FOR ROBOTS.....	65
RELATIONSHIP BETWEEN INDUSTRIAL OUTPUT AND ROBOT SALES	66
<i>FIGURE 5 BASELINE RELATIONSHIP OF INDUSTRIAL ROBOT SALES AND MANUFACTURING GROSS OUTPUT FROM 1979 TO 2001 (U.S.) (UNITS, \$ MILLIONS)</i>	67
FACTORS INFLUENCING ALL SIX TYPES OF ROBOTS	68
THE ONGOING FINANCIAL CRISIS	68
U.S. SHIFTS FOCUS OF ROBOTICS RESEARCH TO THE MILITARY	69
<i>TABLE 33 CHANGES IN RELATIVE IMPORTANCE OF PUBLIC AND PUBLIC-PRIVATE FUNDING SOURCES, 2003-2014 (%)</i>	70
EUROPE COORDINATES ITS ROBOTIC RESEARCH	70
Europe Coordinates Its ... (Continued).....	71
FACTORS AFFECTING DEMAND FOR INDUSTRIAL ROBOTS.....	72
PLUMMETING AUTO SALES.....	72

COMPOSITES WILL LESSEN THE NEED FOR WELDING	
ROBOTS	72
Composites Will Lessen the ... (Continued).....	73
FACTORS AFFECTING DEMAND FOR DOMESTIC SERVICE	
ROBOTS	74
JAPAN'S DOMESTIC AND PROFESSIONAL ROBOTIC	
INITIATIVES	75
TABLE 34 JAPAN'S DOMESTIC SERVICE ROBOT INITIATIVE.....	75
TABLE 35 JAPAN'S PROFESSIONAL SERVICE ROBOT INITIATIVE.....	76
TAIWAN SEEKS LEADERSHIP POSITION	76
FACTORS AFFECTING PROFESSIONAL SERVICE ROBOTS	76
FACTORS AFFECTING PROFESSIONAL ... (CONTINUED)	77
TABLE 36 U.S. FINANCED ROBOT PROJECTS–CIVILIAN AGENCIES	
(1983 THROUGH 2009 FISCAL YEAR)	78
TABLE 36 (CONTINUED).....	79
FACTORS AFFECTING MILITARY ROBOTICS	80
WARS FOSTER CONTINUING DEVELOPMENT	80
Wars Foster Continuing Development (Continued)	81
Wars Foster Continuing Development (Continued)	82
TABLE 37 U.S. ARMED FORCES ROBOT RESEARCH (1983	
THROUGH 2008 FISCAL YEAR)	83
TABLE 37 (CONTINUED).....	84
TABLE 38 ROBOT PROJECTS FINANCED BY THE DEFENSE	
ADVANCED RESEARCH PROJECTS AGENCY (1983 THROUGH	
2009 FISCAL YEAR).....	84
TABLE 39 ROBOT PROJECTS FINANCED BY THE DEPARTMENT OF	
ENERGY (1983 THROUGH 2009 FISCAL YEAR)	85
TYPES AND TIERS OF MILITARY ROBOTS	85
TABLE 40 U.S. AIR FORCE UAV TIERS	86
TABLE 41 U.S. MARINE CORPS UAV TIERS.....	87
TABLE 42 U.S. ARMY UAV TIERS.....	87
TABLE 43 U.S. ARMY FUTURE COMBAT SYSTEM UAV CLASSES.....	87
TABLE 44 SIGNIFICANT NON–U.S. UNMANNED AERIAL VEHICLES.....	88
TABLE 44 (CONTINUED).....	89
TABLE 44 (CONTINUED).....	90
TABLE 44 (CONTINUED).....	91
TABLE 45 SIGNIFICANT U.S. UNMANNED AERIAL VEHICLES.....	91
TABLE 45 (CONTINUED).....	92
FACTORS AFFECTING SECURITY ROBOTS.....	93
FACTORS AFFECTING SPACE ROBOTS.....	94
TABLE 46 NASA FINANCED ROBOTICS PROJECTS (1983 THROUGH	
2009 FISCAL YEAR).....	95
TABLE 46 (CONTINUED).....	96
CHAPTER SEVEN: ROBOT PATENT ANALYSIS	97

<i>TABLE 47 ASSIGNED PATENTS BEARING TITLE “INDUSTRIAL ROBOTS” (BY ORIGINAL ASSIGNEE AND FILING DATE)</i>	97
<i>TABLE 47 (CONTINUED)</i>	98
<i>TABLE 47 (CONTINUED)</i>	99
<i>A TECHNOLOGICAL PERSPECTIVE</i>	99
<i>TABLE 48 ROBOT WRISTS (BY ORIGINAL ASSIGNEE AND FILING DATE)</i>	100
<i>IDENTIFYING TECHNOLOGICAL LEADERSHIP</i>	100
<i>TABLE 49 SIGNIFICANT ASSIGNED ROBOTICS PATENTS (BY ORIGINAL ASSIGNEE AND FILING DATE)</i>	101
<i>TABLE 49 (CONTINUED)</i>	102
<i>TABLE 49 (CONTINUED)</i>	103
<i>TABLE 49 (CONTINUED)</i>	104
<i>TABLE 49 (CONTINUED)</i>	105
<i>TABLE 49 (CONTINUED)</i>	106
<i>TABLE 49 (CONTINUED)</i>	107
<i>TABLE 49 (CONTINUED)</i>	108
<i>TABLE 49 (CONTINUED)</i>	109
<i>TABLE 49 (CONTINUED)</i>	110
<i>TABLE 49 (CONTINUED)</i>	111
<i>TABLE 49 (CONTINUED)</i>	112
<i>TABLE 49 (CONTINUED)</i>	113
<i>TABLE 49 (CONTINUED)</i>	114
<i>TABLE 49 (CONTINUED)</i>	115
<i>TABLE 49 (CONTINUED)</i>	116
<i>TABLE 49 (CONTINUED)</i>	117
<i>TABLE 49 (CONTINUED)</i>	118
<i>TABLE 49 (CONTINUED)</i>	119
<i>TABLE 49 (CONTINUED)</i>	120
<i>TABLE 49 (CONTINUED)</i>	121
<i>TABLE 49 (CONTINUED)</i>	122
<i>TABLE 49 (CONTINUED)</i>	123
<i>TABLE 49 (CONTINUED)</i>	124
<i>TABLE 49 (CONTINUED)</i>	125
<i>TABLE 49 (CONTINUED)</i>	126
<i>TABLE 49 (CONTINUED)</i>	127
<i>TABLE 49 (CONTINUED)</i>	128
<i>TABLE 49 (CONTINUED)</i>	129
<i>TABLE 49 (CONTINUED)</i>	130
<i>TABLE 49 (CONTINUED)</i>	131
<i>TABLE 49 (CONTINUED)</i>	132
<i>TABLE 49 (CONTINUED)</i>	133
<i>TABLE 49 (CONTINUED)</i>	134
<i>USING PATENTS TO IDENTIFY KEY NICHE MARKET PLAYERS</i>	134

<i>TABLE 50 ASSIGNED PATENTS FOR CLEANING ROBOTS (BY ORIGINAL ASSIGNEE)</i>	135
<i>TABLE 50 (CONTINUED)</i>	136
<i>TABLE 50 (CONTINUED)</i>	137
<i>TABLE 51 ASSIGNED PATENTS FOR MILKING ROBOTS (BY ORIGINAL ASSIGNEE)</i>	137
<i>TABLE 51 (CONTINUED)</i>	138
<i>TABLE 51 (CONTINUED)</i>	139
<i>TABLE 51 (CONTINUED)</i>	140
<i>TABLE 51 (CONTINUED)</i>	141
<i>TABLE 51 (CONTINUED)</i>	142
<i>TABLE 51 (CONTINUED)</i>	143
<i>TABLE 51 (CONTINUED)</i>	144
<i>TABLE 51 (CONTINUED)</i>	145
<i>TABLE 51 (CONTINUED)</i>	146
<i>TABLE 51 (CONTINUED)</i>	147
<i>TABLE 51 (CONTINUED)</i>	148
<i>TABLE 51 (CONTINUED)</i>	149
<i>TABLE 52 ASSIGNED PATENTS FOR ROBOTIC TELEMATICS (BY ORIGINAL ASSIGNEE AND FILING DATE)</i>	149
<i>TABLE 52 (CONTINUED)</i>	150
<i>TABLE 52 (CONTINUED)</i>	151
<i>TABLE 52 (CONTINUED)</i>	152
<i>TABLE 52 (CONTINUED)</i>	153
<i>TABLE 52 (CONTINUED)</i>	154
<i>TABLE 52 (CONTINUED)</i>	155
<i>TABLE 52 (CONTINUED)</i>	156
<i>TABLE 52 (CONTINUED)</i>	157
<i>TABLE 52 (CONTINUED)</i>	158
<i>TABLE 52 (CONTINUED)</i>	159
<i>TABLE 52 (CONTINUED)</i>	160
<i>TABLE 52 (CONTINUED)</i>	161
<i>TABLE 52 (CONTINUED)</i>	162
<i>TABLE 52 (CONTINUED)</i>	163
<i>TABLE 52 (CONTINUED)</i>	164
<i>TABLE 52 (CONTINUED)</i>	165
<i>TABLE 52 (CONTINUED)</i>	166
<i>TABLE 52 (CONTINUED)</i>	167
<i>TABLE 52 (CONTINUED)</i>	168
<i>TABLE 52 (CONTINUED)</i>	169
<i>TABLE 52 (CONTINUED)</i>	170
<i>TABLE 52 (CONTINUED)</i>	171
<i>TABLE 52 (CONTINUED)</i>	172

ABSTRACTS OF NOTEWORTHY ROBOTICS PATENTS, BY	
PATENT NUMBER	172
PROGRAMMED ARTICLE TRANSFER.....	172
METHOD FOR TRANSFERRING WAFERS IN A	
SEMICONDUCTOR TAPE–PEELING APPARATUS	173
WELDING MACHINE AND METHOD FOR ASSEMBLING	
SAME.....	173
LINKING ELEMENT WITH SCREW JACK AND ITS USE FOR	
AN INDUSTRIAL ROBOT ARM.....	174
PAINT SPRAY BOOTH WITH ROBOT	174
SUPPORTING STRUCTURE	174
METHOD AND APPARATUS FOR PROCESSING WAFERS	175
LIGHT–PINPOINTING DEVICE FOR A ROBOT.....	175
REMOTE CONTROL SYSTEM FOR BIPED LOCOMOTION	
ROBOT	176
SCARA–TYPE ROBOT WITH COUNTERBALANCED ARMS	176
STACK GRASPER FOR SHEET–LIKE PRODUCTS AND	
METHOD OF PALLETIZING USING A STACK GRASPER	177
ERROR RECOVERY METHODS FOR CONTROLLING	
ROBOTIC SYSTEMS	177
SYSTEM AND METHOD FOR AUTOMATICALLY FOCUSING	
THE ATTENTION OF A VIRTUAL ROBOT INTERACTING	
WITH USERS.....	178
CHAPTER EIGHT: ROBOT FORECASTS.....	179
TABLE 53 WORLDWIDE DEMAND FOR ROBOTS, BY INDUSTRY AND	
COMPONENT, THROUGH 2014 (\$ MILLIONS).....	179
TABLE 53 (CONTINUED).....	180
TABLE 54 ROBOTS DEMAND IN NORTH AMERICAN, BY INDUSTRY	
AND COMPONENT, THROUGH 2014 (\$ MILLIONS).....	180
TABLE 54 (CONTINUED).....	181
TABLE 55 ROBOTS DEMAND IN THE EUROPEAN UNION, BY	
INDUSTRY AND COMPONENT, THROUGH 2014.....	182
TABLE 56 ROBOTS DEMAND IN ASIA, BY INDUSTRY AND	
COMPONENT, THROUGH 2014 (\$ MILLIONS).....	183
TABLE 57 ROBOTS DEMAND IN THE REST OF THE WORLD, BY	
INDUSTRY AND COMPONENT, THROUGH 2014 (\$ MILLIONS).....	184
TABLE 58 ROBOT DEMAND BY INDUSTRY AND COMPONENT,	
THROUGH 2014 (\$ MILLIONS).....	185
TABLE 58 (CONTINUED).....	186
TABLE 58 (CONTINUED).....	187
CHAPTER NINE: ROBOTICS COMMUNITY PROFILES	188
ABB.....	188
ADEPT TECHNOLOGY, INC.	188

ADVANCING ROBOTICS TECHNOLOGY FOR SOCIETAL IMPACT	
ALLIANCE.....	189
APPLIED MATERIALS, INC.	189
CARE PARTNERS	189
CARNEGIE MELLON UNIVERSITY ROBOTICS INSTITUTE.....	190
COLLÈGE DE FRANCE.....	191
COMAU	192
DENSO ROBOTICS	192
EUROPEAN ROBOTICS RESEARCH NETWORK (EURON)	192
EUROPEAN TECHNOLOGY PLATFORMS.....	193
FANUC LTD.....	193
FARADAY ADVANCE	193
FOSTER–MILLER.....	194
FUJITSU FANUC	194
GENESIS SYSTEMS GROUP, LLC.....	194
HITACHI, LTD.....	194
HONDA.....	195
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS	
(IEEE).....	195
INTERNATIONAL FEDERATION OF ROBOTICS (IFR).....	195
INTERNATIONAL ORGANIZATION FOR STANDARDIZATION	
(ISO)	196
IROBOT CORP.....	196
JOINT ROBOTICS PROGRAM (JRP).....	196
KAROLINSKA INSTITUTET.....	197
KAWASAKI ROBOTICS.....	197
KUKA ROBOTICS OF NORTH AMERICA	197
MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT).....	198
MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD	198
MITSUBISHI.....	198
MOTOMAN	199
NACHI ROBOTICS.....	199
NATIONAL ROBOTICS ENGINEERING CENTER	199
PILZ AUTOMATION	200
ROBOTICS INDUSTRY ASSOCIATION (RIA).....	200
ROBOTICS ALLIANCE PROJECT.....	200
ROBOTICS SOCIETY OF JAPAN	200
SICK, INC.....	200
STÄUBLI	201
UNIMATION	201
UNIVERSITÀ CAMPUS BIO-MEDICO.....	201
UNIVERSITÀ DI FERRARA	201
UNIVERSITAT AUTÒNOMA DE BARCELONA.....	201
UNIVERSITÉ PIERRE ET MARIE CURIE	201

UNIVERSITY OF CALIFORNIA—MERCED	202
UNIVERSITY OF CALIFORNIA—SAN DIEGO	202
UNIVERSITY OF CALIFORNIA—SANTA CRUZ.....	202
UNIVERSITY OF CHICAGO	202
UNIVERSITY OF FLORIDA	202
UNIVERSITY OF MASSACHUSETTS—AMHERST.....	202
UNIVERSITY OF MIAMI.....	202
UNIVERSITY OF MICHIGAN—ANN ARBOR.....	203
UNIVERSITY OF NEW MEXICO	203
UNIVERSITY OF PARMA	203
UNIVERSITY OF PENNSYLVANIA	203
UNIVERSITY OF WASHINGTON.....	203
UNIVERSITY RESEARCH PROGRAM IN ROBOTICS.....	203
VECNA TECHNOLOGIES	204
VENTAX ROBOT, INC.	204
VIGYAN RESEARCH ASSOCIATES, INC.....	204
VIKING ENERGY CORP.....	204
WASEDA UNIVERSITY.....	204
WORCESTER POLYTECHNIC INSTITUTE.....	204
WORKSCIENCE CORP.....	205
YALE UNIVERSITY	205
YASKAWA ELECTRIC	205