





SUBSTANTIAL DETAILS HAVE ALSO BEEN INCLUDED ON THE ARCHITECTURE OF HYBRID EXCAVATORS IN THE CHAPTER RELATED TO SPECIAL HYBRID VEHICLES. ALSO INCLUDED IS A CHAPTER PROVIDING AN OVERVIEW OF HYBRID VEHICLE TECHNOLOGY, WHICH OFFERS A PERSPECTIVE ON THE CURRENT DEBATE ON SUSTAINABILITY AND THE ENVIRONMENTAL IMPACT OF HYBRID AND ELECTRIC VEHICLE TECHNOLOGY. COMPLETELY UPDATED WITH NEW CHAPTERS COVERS RECENT DEVELOPMENTS, BREAKTHROUGHS, AND TECHNOLOGIES, INCLUDING NEW DRIVE TOPOLOGIES EXPLAINS HEV FUNDAMENTALS AND APPLICATIONS OFFERS A HOLISTIC PERSPECTIVE ON VEHICLE ELECTRIFICATION HYBRID ELECTRIC VEHICLES: PRINCIPLES AND APPLICATIONS WITH PRACTICAL PERSPECTIVES, SECOND EDITION IS A GREAT RESOURCE FOR RESEARCHERS AND PRACTITIONERS IN THE AUTOMOTIVE INDUSTRY, AS WELL AS FOR GRADUATE STUDENTS IN AUTOMOTIVE ENGINEERING.

**AUTOMATIC SOLAR TRACKING SUN TRACKING SATELLITE TRACKING RASTREADOR SOLAR SEGUIMIENTO SOLAR SEGUIDOR SOLAR AUTOMATIZACION DE SEGUIMIENTO SOLAR**
**GERRO PRINSLOO 2015-11-01**
**AUTOMATIC SOLAR TRACKING SUN TRACKING : THIS BOOK DETAILS AUTOMATIC SOLAR-TRACKING, SUN-TRACKING-SYSTEMS, SOLAR-TRACKERS AND SUN TRACKER SYSTEMS. AN INTELLIGENT AUTOMATIC SOLAR TRACKER IS A DEVICE THAT ORIENTS A PAYLOAD TOWARD THE SUN. SUCH PROGRAMMABLE COMPUTER BASED SOLAR TRACKING DEVICE INCLUDES PRINCIPLES OF SOLAR TRACKING, SOLAR TRACKING SYSTEMS, AS WELL AS MICROCONTROLLER, MICROPROCESSOR AND/OR PC BASED SOLAR TRACKING CONTROL TO ORIENTATE SOLAR REFLECTORS, SOLAR LENSES, PHOTOVOLTAIC PANELS OR OTHER OPTICAL CONFIGURATIONS TOWARDS THE SUN. MOTORIZED SPACE FRAMES AND KINEMATIC SYSTEMS ENSURE MOTION DYNAMICS AND EMPLOY DRIVE TECHNOLOGY AND GEARING PRINCIPLES TO STEER OPTICAL CONFIGURATIONS SUCH AS MANGIN, PARABOLIC, CONIC, OR CASSEGRAIN SOLAR ENERGY COLLECTORS TO FACE THE SUN AND FOLLOW THE SUN MOVEMENT CONTOUR CONTINUOUSLY (SEGUIMIENTO SOLAR Y AUTOMATIZACION, AUTOMATIZACION SEGUIDOR SOLAR, TRACKING SOLAR E AUTOMATIZACION, SEGUIDOR SOLAR, INSEGUIMENTO SOLARE, ENERGIA TERMICA, SOLE SEQUITO, POSIZIONATORE MOTORIZZATO) IN HARNESSING POWER FROM THE SUN THROUGH A SOLAR TRACKER OR PRACTICAL SOLAR TRACKING SYSTEM, RENEWABLE ENERGY CONTROL AUTOMATION SYSTEMS REQUIRE AUTOMATIC SOLAR TRACKING SOFTWARE AND SOLAR POSITION ALGORITHMS TO ACCOMPLISH DYNAMIC MOTION CONTROL WITH CONTROL AUTOMATION ARCHITECTURE, CIRCUIT BOARDS AND HARDWARE. ON-AXIS SUN TRACKING SYSTEM SUCH AS THE ALTITUDE-AZIMUTH DUAL AXIS OR MULTI-AXIS SOLAR TRACKER SYSTEMS USE A SUN TRACKING ALGORITHM OR RAY TRACING SENSORS OR SOFTWARE TO ENSURE THE SUN’S PASSAGE THROUGH THE SKY IS TRACED WITH HIGH PRECISION IN AUTOMATED SOLAR TRACKER APPLICATIONS, RIGHT THROUGH SUMMER SOLSTICE, SOLAR EQUINOX AND WINTER SOLSTICE. A HIGH PRECISION SUN POSITION CALCULATOR OR SUN POSITION ALGORITHM IS THIS AN IMPORTANT STEP IN THE DESIGN AND CONSTRUCTION OF AN AUTOMATIC SOLAR TRACKING SYSTEM. THE CONTENT OF THE BOOK IS ALSO APPLICABLE TO COMMUNICATION ANTENNA SATELLITE TRACKING AND MOON TRACKING ALGORITHM SOURCE CODE FOR WHICH LINKS TO FREE DOWNLOAD LINKS ARE PROVIDED. FROM SUN TRACING SOFTWARE PERSPECTIVE, THE SONNET TRACING THE SUN HAS A LITERAL MEANING. WITHIN THE CONTEXT OF SUN TRACK AND TRACE, THIS BOOK EXPLAINS THAT THE SUN’S DAILY PATH ACROSS THE SKY IS DIRECTED BY RELATIVELY SIMPLE PRINCIPLES, AND IF GRASPED/UNDERSTOOD, THEN IT IS RELATIVELY EASY TO TRACE THE SUN WITH SUN FOLLOWING SOFTWARE. SUN POSITION COMPUTER SOFTWARE FOR TRACING THE SUN ARE AVAILABLE AS OPEN SOURCE CODE, SOURCES THAT IS LISTED IN THIS BOOK. THE BOOK ALSO DESCRIBES THE USE OF SATELLITE TRACKING SOFTWARE AND MECHANISMS IN SOLAR TRACKING APPLICATIONS. IRONICALLY THERE WAS EVEN A SYSTEM CALLED SUN CHASER, SAID TO HAVE BEEN A SOLAR POSITIONER SYSTEM KNOWN FOR CHASING THE SUN THROUGHOUT THE DAY. USING SOLAR EQUATIONS IN AN ELECTRONIC CIRCUIT FOR AUTOMATIC SOLAR TRACKING IS QUITE SIMPLE, EVEN IF YOU ARE A NOVICE, BUT MATHEMATICAL SOLAR EQUATIONS ARE OVER COMPLICATED BY ACADEMIC EXPERTS AND PROFESSORS IN TEXT-BOOKS, JOURNAL ARTICLES AND INTERNET WEBSITES. IN TERMS OF SOLAR HOBBIES, SCHOLARS, STUDENTS AND HOBBYIST’S LOOKING AT SOLAR TRACKING ELECTRONICS OR PC PROGRAMS FOR SOLAR TRACKING ARE USUALLY OVERCOME BY THE SHEER VOLUME OF SCIENTIFIC MATERIAL AND INTERNET RESOURCES, WHICH LEAVES MANY DEVELOPERS IN FRUSTRATION WHEN SEARCH FOR SIMPLE EXPERIMENTAL SOLAR TRACKING SOURCE-CODE FOR THEIR ON-AXIS SUN-TRACKING SYSTEMS. THIS BOOKLET WILL SIMPLIFY THE SEARCH FOR THE MYSTICAL SUN TRACKING FORMULAS FOR YOUR SUN TRACKER INNOVATION AND HELP YOU DEVELOP YOUR OWN AUTONOMOUS SOLAR TRACKING CONTROLLER. BY DIRECTING THE SOLAR COLLECTOR DIRECTLY INTO THE SUN, A SOLAR HARVESTING MEANS OR DEVICE CAN HARNESS SUNLIGHT OR THERMAL HEAT. THIS IS ACHIEVED WITH THE HELP OF SUN ANGLE FORMULAS, SOLAR ANGLE FORMULAS OR SOLAR TRACKING PROCEDURES FOR THE CALCULATION OF SUN’S POSITION IN THE SKY. AUTOMATIC SUN TRACKING SYSTEM SOFTWARE INCLUDES ALGORITHMS FOR SOLAR ALTITUDE AZIMUTH ANGLE CALCULATIONS REQUIRED IN FOLLOWING THE SUN ACROSS THE SKY. IN USING THE LONGITUDE, LATITUDE GPS COORDINATES OF THE SOLAR TRACKER LOCATION, THESE SUN TRACKING SOFTWARE TOOLS SUPPORTS PRECISION SOLAR TRACKING BY DETERMINING THE SOLAR ALTITUDE-AZIMUTH COORDINATES FOR THE SUN TRAJECTORY IN ALTITUDE-AZIMUTH TRACKING AT THE TRACKER LOCATION, USING CERTAIN SUN ANGLE FORMULAS IN SUN VECTOR CALCULATIONS. INSTEAD OF FOLLOW THE SUN SOFTWARE, A SUN TRACKING SENSOR SUCH AS A SUN SENSOR OR WEBCAM OR VIDEO CAMERA WITH VISION BASED SUN FOLLOWING IMAGE PROCESSING SOFTWARE CAN ALSO BE USED TO DETERMINE THE POSITION OF THE SUN OPTICALLY. SUCH OPTICAL FEEDBACK DEVICES ARE OFTEN USED IN SOLAR PANEL TRACKING SYSTEMS AND DISH TRACKING SYSTEMS. DYNAMIC SUN TRACING IS ALSO USED IN SOLAR SURVEYING, DNI ANALYSER AND SUN SURVEYING SYSTEMS THAT BUILD SOLAR INFOGRAPHICS MAPS WITH SOLAR RADIANCE, IRRADIANCE AND DNI MODELS FOR GIS (GEOGRAPHICAL INFORMATION SYSTEM). IN THIS WAY GEOSPATIAL METHODS ON SOLAR/ENVIRONMENT INTERACTION MAKES USE OF GEOSPATIAL TECHNOLOGIES (GIS, REMOTE SENSING, AND CARTOGRAPHY). CLIMATIC DATA AND WEATHER STATION OR WEATHER CENTER DATA, AS WELL AS QUERIES FROM SKY SERVERS AND SOLAR RESOURCE DATABASE SYSTEMS (I.E. ON DB2, SYBASE, ORACLE, SQL, MYSQL) MAY ALSO BE ASSOCIATED WITH SOLAR GIS MAPS. IN SUCH SOLAR RESOURCE MODELLING SYSTEMS, A PYRANOMETER OR SOLARIMETER IS NORMALLY USED IN ADDITION TO MEASURE DIRECT AND INDIRECT, SCATTERED, DISPERSED, REFLECTIVE RADIATION FOR A PARTICULAR GEOGRAPHICAL LOCATION. SUNLIGHT ANALYSIS IS IMPORTANT IN FLASH PHOTOGRAPHY WHERE PHOTOGRAPHIC LIGHTING ARE IMPORTANT FOR PHOTOGRAPHERS. GIS SYSTEMS ARE USED BY ARCHITECTS WHO ADD SUN SHADOW APPLETS TO STUDY ARCHITECTURAL SHADING OR SUN SHADOW ANALYSIS, SOLAR FLUX CALCULATIONS, OPTICAL MODELLING OR TO PERFORM WEATHER MODELLING. SUCH SYSTEMS OFTEN EMPLOY A COMPUTER OPERATED TELESCOPE TYPE MECHANISM WITH RAY TRACING PROGRAM SOFTWARE AS A SOLAR NAVIGATOR OR SUN TRACER THAT DETERMINES THE SOLAR POSITION AND INTENSITY. THE PURPOSE OF THIS BOOKLET IS TO ASSIST DEVELOPERS TO TRACK AND TRACE SUITABLE SOURCE-CODE AND SOLAR TRACKING ALGORITHMS FOR THEIR APPLICATION, WHETHER A HOBBYIST, SCIENTIST, TECHNICIAN OR ENGINEER. MANY OPEN-SOURCE SUN FOLLOWING AND TRACKING ALGORITHMS AND SOURCE-CODE FOR SOLAR TRACKING PROGRAMS AND MODULES ARE FREELY AVAILABLE TO DOWNLOAD ON THE INTERNET TODAY. CERTAIN PROPRIETARY SOLAR TRACKER KITS AND SOLAR TRACKING CONTROLLERS INCLUDE A SOFTWARE DEVELOPMENT KIT SDK FOR ITS APPLICATION PROGRAMMING INTERFACE API ATTRIBUTES (PEBBLE). WIDGET LIBRARIES, WIDGET TOOLKITS, GUI TOOLKIT AND UX LIBRARIES WITH GRAPHICAL CONTROL ELEMENTS ARE ALSO AVAILABLE TO CONSTRUCT THE GRAPHICAL USER INTERFACE (GUI) FOR YOUR SOLAR TRACKING OR SOLAR POWER MONITORING PROGRAM. THE SOLAR LIBRARY USED BY SOLAR POSITION CALCULATORS, SOLAR SIMULATION SOFTWARE AND SOLAR CONTOUR CALCULATORS INCLUDE MACHINE PROGRAM CODE FOR THE SOLAR HARDWARE CONTROLLER WHICH ARE SOFTWARE PROGRAMMED INTO MICRO-CONTROLLERS, PROGRAMMABLE LOGIC CONTROLLERS PLC, PROGRAMMABLE GATE ARRAYS, ARDUINO PROCESSOR OR PIC PROCESSOR. PC BASED SOLAR TRACKING IS ALSO HIGH IN DEMAND USING C++, VISUAL BASIC VB, AS WELL AS MS WINDOWS, LINUX AND APPLE MAC BASED OPERATING SYSTEMS FOR SUN PATH TABLES ON MATLAB, EXCEL. SOME BOOKS AND INTERNET WEBPAGES USE OTHER TERMS, SUCH AS: SUN ANGLE CALCULATOR, SUN POSITION CALCULATOR OR SOLAR ANGLE CALCULATOR. AS SAID, SUCH SOFTWARE CODE CALCULATE THE SOLAR AZIMUTH ANGLE, SOLAR ALTITUDE ANGLE, SOLAR ELEVATION ANGLE OR THE SOLAR ZENITH ANGLE (ZENITH SOLAR ANGLE IS SIMPLY REFERENCED FROM VERTICAL PLANE, THE MIRROR OF THE ELEVATION ANGLE MEASURED FROM THE HORIZONTAL OR GROUND PLANE LEVEL). SIMILAR SOFTWARE CODE IS ALSO USED IN SOLAR CALCULATOR APPS OR THE SOLAR POWER CALCULATOR APPS FOR IOS AND ANDROID SMARTPHONE DEVICES. MOST OF THESE SMARTPHONE SOLAR MOBILE APPS SHOW THE SUN PATH AND SUN-ANGLES FOR ANY LOCATION AND DATE OVER A 24 HOUR PERIOD. SOME SMARTPHONES INCLUDE AUGMENTED REALITY FEATURES IN WHICH YOU CAN PHYSICALLY SEE AND LOOK AT THE SOLAR PATH THROUGH YOUR CELL PHONE CAMERA OR MOBILE PHONE CAMERA AT YOUR PHONE’S SPECIFIC GPS LOCATION. IN THE COMPUTER PROGRAMMING AND DIGITAL SIGNAL PROCESSING (DSP) ENVIRONMENT, (FREE/OPEN SOURCE) PROGRAM CODE ARE AVAILABLE FOR VB, .NET, DELPHI, PYTHON, C, C+, C++, PHP, SWIFT, ADM, F, FLASH, BASIC, QBASIC, GBASIC, KBASIC, SIMPL LANGUAGE, SQUIRREL, SOLARIS, ASSEMBLY LANGUAGE ON OPERATING SYSTEMS SUCH AS MS WINDOWS, APPLE MAC, DOS OR LINUX OS. SOFTWARE ALGORITHMS PREDICTING POSITION OF THE SUN IN THE SKY ARE COMMONLY AVAILABLE AS GRAPHICAL PROGRAMMING PLATFORMS SUCH AS MATLAB (MATHWORKS), SIMULINK MODELS, JAVA APPLETS, TRNSYS SIMULATIONS, SCADA SYSTEM APPS, LABVIEW MODULE, BECKHOFF TWINCAT (VISUAL STUDIO), SIEMENS SPA, MOBILE AND IPHONE APPS, ANDROID OR IOS TABLET APPS, AND SO FORTH. AT THE SAME TIME, PLC SOFTWARE CODE FOR A RANGE OF SUN TRACKING AUTOMATION TECHNOLOGY CAN FOLLOW THE PROFILE OF SUN IN SKY FOR SIEMENS, HP, PANASONIC, ABB, ALLAN BRADLEY, OMRON, SEW, FESTO, BECKHOFF, ROCKWELL, SCHNEIDER, ENDRESS HAUSER, FUDJI ELECTRIC. HONEYWELL, FUCHS, YOKONAWA, OR MUTHIBISHI PLATFORMS. SUN PATH PROJECTION SOFTWARE ARE ALSO AVAILABLE FOR A RANGE OF MODULAR IPC EMBEDDED PC MOTHERBOARDS, INDUSTRIAL PC, PLC (PROGRAMMABLE LOGIC CONTROLLER) AND PAC (PROGRAMMABLE AUTOMATION CONTROLLER) SUCH AS THE SIEMENS S7-1200 OR SIEMENS LOGO, BECKHOFF IPC OR CX SERIES, OMRON PLC, ERCAM PLC, AC500PLC ABB, NATIONAL INSTRUMENTS NIPXI OR NI CRIO, PIC PROCESSOR, INTEL 8051/8085, IBM (CELL, POWER, BRAIN OR TRUENIX SERIES), FPGA (XILINX ALTERA NIOS), INTEL, XEON, ATMEL MEGA AVR, MPU, MAPLE, TEENSY, MSP, XMOS, XBEE, ARM, RASPBERRY PI, EAGLE, ARDUINO OR ARDUINO ATMEGA MICROCONTROLLER, WITH SERVO MOTOR, STEPPER MOTOR, DIRECT CURRENT DC PULSE WIDTH MODULATION PWM (CURRENT DRIVER) OR ALTERNATING CURRENT AC SPS OR IPC VARIABLE FREQUENCY DRIVES VFD MOTOR DRIVES (ALSO TERMED ADJUSTABLE-FREQUENCY DRIVE, VARIABLE-SPEED DRIVE, AC DRIVE, MICRO DRIVE OR INVERTER DRIVE) FOR ELECTRICAL, MECHATRONIC, PNEUMATIC, OR HYDRAULIC SOLAR TRACKING ACTUATORS. THE ABOVE MOTION CONTROL AND ROBOT CONTROL SYSTEMS INCLUDE ANALOGUE OR DIGITAL INTERFACING PORTS ON THE PROCESSORS TO ALLOW FOR TRACKER ANGLE ORIENTATION FEEDBACK CONTROL THROUGH ONE OR A COMBINATION OF ANGLE SENSOR OR ANGLE ENCODER, SHAFT ENCODER, PRECISION ENCODER, OPTICAL ENCODER, MAGNETIC ENCODER, DIRECTION ENCODER, ROTATIONAL ENCODER, CHIP ENCODER, TILT SENSOR, INCLINATION SENSOR, OR PITCH SENSOR. NOTE THAT THE TRACKER’S ELEVATION OR ZENITH AXIS ANGLE MAY MEASURED USING AN ALTITUDE ANGLE-, DECLINATION ANGLE-, INCLINATION ANGLE-, PITCH ANGLE-, OR VERTICAL ANGLE-, ZENITH ANGLE- SENSOR OR INCLINOMETER. SIMILARLY THE TRACKER’S AZIMUTH AXIS ANGLE BE MEASURED WITH A AZIMUTH ANGLE-, HORIZONTAL ANGLE-, OR ROLL ANGLE- SENSOR. CHIP INTEGRATED ACCELEROMETER MAGNETOMETER GYROSCOPE TYPE ANGLE SENSORS CAN ALSO BE USED TO CALCULATE DISPLACEMENT. OTHER OPTIONS INCLUDE THE USE OF THERMAL IMAGING SYSTEMS SUCH AS A FLUKE THERMAL IMAGER, OR ROBOTIC OR VISION BASED SOLAR TRACKER SYSTEMS THAT EMPLOY FACE TRACKING, HEAD TRACKING, HAND TRACKING, EYE TRACKING AND CAR TRACKING PRINCIPLES IN SOLAR TRACKING. WITH UNATTENDED DECENTRALISED RURAL, ISLAND, ISOLATED, OR AUTONOMOUS OFF-GRID POWER INSTALLATIONS, REMOTE CONTROL, MONITORING, DATA ACQUISITION, DIGITAL DATALOGGING AND ONLINE MEASUREMENT AND VERIFICATION EQUIPMENT BECOMES CRUCIAL. IT ASSISTS THE OPERATOR WITH SUPERVISORY CONTROL TO MONITOR THE EFFICIENCY OF REMOTE RENEWABLE ENERGY RESOURCES AND SYSTEMS AND PROVIDE VALUABLE WEB-BASED FEEDBACK IN TERMS OF CO2 AND CLEAN DEVELOPMENT MECHANISM (CDM) REPORTING. A POWER QUALITY ANALYSER FOR DIAGNOSTICS THROUGH INTERNET, WIFI AND CELLULAR MOBILE LINKS IS MOST VALUABLE IN FRONTLINE TROUBLESHOOTING AND PREDICTIVE MAINTENANCE, WHERE QUICK DIAGNOSTIC ANALYSIS IS REQUIRED TO DETECT AND PREVENT POWER QUALITY ISSUES. SOLAR TRACKER APPLICATIONS COVER A WIDE SPECTRUM OF SOLAR APPLICATIONS AND SOLAR ASSISTED APPLICATION, INCLUDING CONCENTRATED SOLAR POWER GENERATION, SOLAR DESALINATION, SOLAR WATER PURIFICATION, SOLAR STEAM GENERATION, SOLAR ELECTRICITY GENERATION, SOLAR INDUSTRIAL PROCESS HEAT, SOLAR THERMAL HEAT STORAGE, SOLAR FOOD DRYERS, SOLAR WATER PUMPING, HYDROGEN PRODUCTION FROM METHANE OR PRODUCING HYDROGEN AND OXYGEN FROM WATER (HHO) THROUGH ELECTROLYSIS. MANY PATENTED OR NON-PATENTED SOLAR APPARATUS INCLUDE TRACKING IN SOLAR APPARATUS FOR SOLAR ELECTRIC GENERATOR, SOLAR DESALINATOR, SOLAR STEAM ENGINE, SOLAR ICE MAKER, SOLAR WATER PURIFIER, SOLAR COOLING, SOLAR REFRIGERATION, USB SOLAR CHARGER, SOLAR PHONE CHARGING, PORTABLE SOLAR CHARGING TRACKER, SOLAR COFFEE BREWING, SOLAR COOKING OR SOLAR DYING MEANS. YOUR PROJECT MAY BE THE NEXT BREAKTHROUGH OR PATENT, BUT YOUR INVENTION IS HELD BACK BY FRUSTRATION IN SEARCH FOR THE SUN TRACKER YOU REQUIRE FOR YOUR SOLAR POWERED APPLIANCE, SOLAR GENERATOR, SOLAR TRACKER ROBOT, SOLAR FREEZER, SOLAR COOKER, SOLAR DRIER, SOLAR PUMP, SOLAR FREEZER, OR SOLAR DRYER PROJECT. WHETHER YOUR SOLAR ELECTRONIC CIRCUIT DIAGRAM INCLUDE A SIMPLIFIED SOLAR CONTROLLER DESIGN IN A SOLAR ELECTRICITY PROJECT, SOLAR POWER KIT, SOLAR HOBBY KIT, SOLAR STEAM GENERATOR, SOLAR HOT WATER SYSTEM, SOLAR ICE MAKER, SOLAR DESALINATOR, HOBBYIST SOLAR PANELS, HOBBY ROBOT, OR IF YOU ARE DEVELOPING PROFESSIONAL OR HOBBY ELECTRONICS FOR A SOLAR UTILITY OR MICRO SCALE SOLAR POWERPLANT FOR YOUR OWN SOLAR FARM OR SOLAR FARMING, THIS PUBLICATION MAY HELP ACCELERATE THE DEVELOPMENT OF YOUR SOLAR TRACKING INNOVATION. LATELY, SOLAR**

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POLYGENERATION, SOLAR TRIGENERATION (SOLAR TRIPLE GENERATION), AND SOLAR QUAD GENERATION (ADDING DELIVERY OF STEAM, LIQUID/GASEOUS FUEL, OR CAPTURE FOOD-GRADE CO\$ \_2\$) SYSTEMS HAVE NEED FOR AUTOMATIC SOLAR TRACKING. THESE SYSTEMS ARE KNOWN FOR SIGNIFICANT EFFICIENCY INCREASES IN ENERGY YIELD AS A RESULT OF THE INTEGRATION AND RE-USE OF WASTE OR RESIDUAL HEAT AND ARE SUITABLE FOR COMPACT PACKAGED MICRO SOLAR POWERPLANTS THAT COULD BE MANUFACTURED AND TRANSPORTED IN KIT-FORM AND OPERATE ON A PLUG-AND PLAY BASIS. TYPICAL HYBRID SOLAR POWER SYSTEMS INCLUDE COMPACT OR PACKAGED SOLAR MICRO COMBINED HEAT AND POWER (CHP OR mCHP) OR SOLAR MICRO COMBINED, COOLING, HEATING AND POWER (CCCHP, CHPc, mCCHP, OR mCHPC) SYSTEMS USED IN DISTRIBUTED POWER GENERATION. THESE SYSTEMS ARE OFTEN COMBINED IN CONCENTRATED SOLAR CSP AND CPV SMART MICROGRID CONFIGURATIONS FOR OFF-GRID RURAL, ISLAND OR ISOLATED MICROGRID, MINIGRID AND DISTRIBUTED POWER RENEWABLE ENERGY SYSTEMS. SOLAR TRACKING ALGORITHMS ARE ALSO USED IN MODELLING OF TRIGENERATION SYSTEMS USING MATLAB SIMULINK (MODELICA OR TRNSYS) PLATFORM AS WELL AS IN AUTOMATION AND CONTROL OF RENEWABLE ENERGY SYSTEMS THROUGH INTELLIGENT PARSING, MULTI-OBJECTIVE, ADAPTIVE LEARNING CONTROL AND CONTROL OPTIMIZATION STRATEGIES. SOLAR TRACKING ALGORITHMS ALSO FIND APPLICATION IN DEVELOPING SOLAR MODELS FOR COUNTRY OR LOCATION SPECIFIC SOLAR STUDIES, FOR EXAMPLE IN TERMS OF MEASURING OR ANALYSIS OF THE FLUCTUATIONS OF THE SOLAR RADIATION (I.E. DIRECT AND DIFFUSE RADIATION) IN A PARTICULAR AREA. SOLAR DNI, SOLAR IRRADIANCE AND ATMOSPHERIC INFORMATION AND MODELS CAN THUS BE INTEGRATED INTO A SOLAR MAP, SOLAR ATLAS OR GEOGRAPHICAL INFORMATION SYSTEMS (GIS). SUCH MODELS ALLOWS FOR DEFINING LOCAL PARAMETERS FOR SPECIFIC REGIONS THAT MAY BE VALUABLE IN TERMS OF THE EVALUATION OF DIFFERENT SOLAR IN PHOTOVOLTAIC OF CSP SYSTEMS ON SIMULATION AND SYNTHESIS PLATFORMS SUCH AS MATLAB AND SIMULINK OR IN LINEAR OR MULTI-OBJECTIVE OPTIMIZATION ALGORITHM PLATFORMS SUCH AS COMPOSE, ENERGYPLAN OR DER-CAM. A DUAL-AXIS SOLAR TRACKER AND SINGLE-AXIS SOLAR TRACKER MAY USE A SUN TRACKER PROGRAM OR SUN TRACKER ALGORITHM TO POSITION A SOLAR DISH, SOLAR PANEL ARRAY, HELIOSTAT ARRAY, PV PANEL, SOLAR ANTENNA OR INFRARED SOLAR NANTENNA. A SELF-TRACKING SOLAR CONCENTRATOR PERFORMS AUTOMATIC SOLAR TRACKING BY COMPUTING THE SOLAR VECTOR. SOLAR POSITION ALGORITHMS (TWINCAT, SPA, OR PSA ALGORITHMS) USE AN ASTRONOMICAL ALGORITHM TO CALCULATE THE POSITION OF THE SUN. IT USES ASTRONOMICAL SOFTWARE ALGORITHMS AND EQUATIONS FOR SOLAR TRACKING IN THE CALCULATION OF SUN’S POSITION IN THE SKY FOR EACH LOCATION ON THE EARTH AT ANY TIME OF DAY. LIKE AN OPTICAL SOLAR TELESCOPE, THE SOLAR POSITION ALGORITHM PIN-POINTS THE SOLAR REFLECTOR AT THE SUN AND LOCKS ONTO THE SUN’S POSITION TO TRACK THE SUN ACROSS THE SKY AS THE SUN PROGRESSES THROUGHOUT THE DAY. OPTICAL SENSORS SUCH AS PHOTODIODES, LIGHT-DEPENDANT-RESISTORS (LDR) OR PHOTORESISTORS ARE USED AS OPTICAL ACCURACY FEEDBACK DEVICES. LATELY WE ALSO INCLUDED A SECTION IN THE BOOK (WITH LINKS TO MICROPROCESSOR CODE) ON HOW THE PIXART WII INFRARED CAMERA IN THE WII REMOTE OR WIIIMOTE MAY BE USED IN INFRARED SOLAR TRACKING APPLICATIONS. IN ORDER TO HARVEST FREE ENERGY FROM THE SUN, SOME AUTOMATIC SOLAR POSITIONING SYSTEMS USE AN OPTICAL MEANS TO DIRECT THE SOLAR TRACKING DEVICE. THESE SOLAR TRACKING STRATEGIES USE OPTICAL TRACKING TECHNIQUES, SUCH AS A SUN SENSOR MEANS, TO DIRECT SUN RAYS ONTO A SILICON OR CMOS SUBSTRATE TO DETERMINE THE X AND Y COORDINATES OF THE SUN’S POSITION. IN A SOLAR MEMS SUN-SENSOR DEVICE, INCIDENT SUNLIGHT ENTERS THE SUN SENSOR THROUGH A SMALL PIN-HOLE IN A MASK PLATE WHERE LIGHT IS EXPOSED TO A SILICON SUBSTRATE. IN A WEB-CAMERA OR CAMERA IMAGE PROCESSING SUN TRACKING AND SUN FOLLOWING MEANS, OBJECT TRACKING SOFTWARE PERFORMS MULTI OBJECT TRACKING OR MOVING OBJECT TRACKING METHODS. IN AN SOLAR OBJECT TRACKING TECHNIQUE, IMAGE PROCESSING SOFTWARE PERFORMS MATHEMATICAL PROCESSING TO BOX THE OUTLINE OF THE APPARENT SOLAR DISC OR SUN BLOB WITHIN THE CAPTURED IMAGE FRAME, WHILE SUN-LOCALIZATION IS PERFORMED WITH AN EDGE DETECTION ALGORITHM TO DETERMINE THE SOLAR VECTOR COORDINATES. AN AUTOMATED POSITIONING SYSTEM HELP MAXIMIZE THE YIELDS OF SOLAR POWER PLANTS THROUGH SOLAR TRACKING CONTROL TO HARNESS SUN’S ENERGY. IN SUCH RENEWABLE ENERGY SYSTEMS, THE SOLAR PANEL POSITIONING SYSTEM USES A SUN TRACKING TECHNIQUES AND A SOLAR ANGLE CALCULATOR IN POSITIONING PV PANELS IN PHOTOVOLTAIC SYSTEMS AND CONCENTRATED PHOTOVOLTAIC CPV SYSTEMS. AUTOMATIC ON-AXIS SOLAR TRACKING IN A PV SOLAR TRACKING SYSTEM CAN BE DUAL-AXIS SUN TRACKING OR SINGLE-AXIS SUN SOLAR TRACKING. IT IS KNOWN THAT A MOTORIZED POSITIONING SYSTEM IN A PHOTOVOLTAIC PANEL TRACKER INCREASE ENERGY YIELD AND ENSURES INCREASED POWER OUTPUT, EVEN IN A SINGLE AXIS SOLAR TRACKING CONFIGURATION. OTHER APPLICATIONS SUCH AS ROBOTIC SOLAR TRACKER OR ROBOTIC SOLAR TRACKING SYSTEM USES ROBOTICA WITH ARTIFICIAL INTELLIGENCE IN THE CONTROL OPTIMIZATION OF ENERGY YIELD IN SOLAR HARVESTING THROUGH A ROBOTIC TRACKING SYSTEM. AUTOMATIC POSITIONING SYSTEMS IN SOLAR TRACKING DESIGNS ARE ALSO USED IN OTHER FREE ENERGY GENERATORS, SUCH AS CONCENTRATED SOLAR THERMAL POWER CSP AND DISH STIRLING SYSTEMS. THE SUN TRACKING DEVICE IN A SOLAR COLLECTOR IN A SOLAR CONCENTRATOR OR SOLAR COLLECTOR SUCH A PERFORMS ON-AXIS SOLAR TRACKING, A DUAL AXIS SOLAR TRACKER ASSISTS TO HARNESS ENERGY FROM THE SUN THROUGH AN OPTICAL SOLAR COLLECTOR, WHICH CAN BE A PARABOLIC MIRROR, PARABOLIC REFLECTOR, FRESNEL LENS OR MIRROR ARRAY/MATRIX. A PARABOLIC DISH OR REFLECTOR IS DYNAMICALLY STEERED USING A TRANSMISSION SYSTEM OR SOLAR TRACKING SLEW DRIVE MEAN. IN STEERING THE DISH TO FACE THE SUN, THE POWER DISH ACTUATOR AND ACTUATION MEANS IN A PARABOLIC DISH SYSTEM OPTICALLY FOCUSSES THE SUN’S ENERGY ON THE FOCAL POINT OF A PARABOLIC DISH OR SOLAR CONCENTRATING MEANS. A STIRLING ENGINE, SOLAR HEAT PIPE, THERMOSYPHIN, SOLAR PHASE CHANGE MATERIAL PCM RECEIVER, OR A FIBRE OPTIC SUNLIGHT RECEIVER MEANS IS LOCATED AT THE FOCAL POINT OF THE SOLAR CONCENTRATOR. THE DISH STIRLING ENGINE CONFIGURATION IS REFERRED TO AS A DISH STIRLING SYSTEM OR STIRLING POWER GENERATION SYSTEM. HYBRID SOLAR POWER SYSTEMS (USED IN COMBINATION WITH BIOGAS, BIOFUEL, PETROL, ETHANOL, DIESEL, NATURAL GAS OR PNG) USE A COMBINATION OF POWER SOURCES TO HARNESS AND STORE SOLAR ENERGY IN A STORAGE MEDIUM. ANY MULTITUDE OF ENERGY SOURCES CAN BE COMBINED THROUGH THE USE OF CONTROLLERS AND THE ENERGY STORED IN BATTERIES, PHASE CHANGE MATERIAL, THERMAL HEAT STORAGE, AND IN COGENERATION FORM CONVERTED TO THE REQUIRED POWER USING THERMODYNAMIC CYCLES (ORGANIC RANKIN, BRAYTON CYCLE, MICRO TURBINE, STIRLING) WITH AN INVERTER AND CHARGE CONTROLLER.

**INTRODUCTION TO MICROCONTROLLER PROGRAMMING FOR POWER ELECTRONICS CONTROL APPLICATIONS**
**MATTIA ROSSI 2021-09-29**
**MICROCONTROLLER PROGRAMMING IS NOT A TRIVIAL TASK. INDEED, IT IS NECESSARY TO SET CORRECTLY THE REQUIRED PERIPHERALS BY USING PROGRAMMING LANGUAGES LIKE C/C++ OR DIRECTLY MACHINE CODE. NEVERTHELESS, MATHWORKS® DEVELOPED A MODEL-BASED WORKFLOW LINKED WITH AN AUTOMATIC CODE GENERATION TOOL ABLE TO TRANSLATE SIMULINK® SCHEMES INTO EXECUTABLE FILES. THIS REPRESENTS A RAPID PROTOTYPING PROCEDURE, AND IT CAN BE APPLIED TO MANY MICROCONTROLLER BOARDS AVAILABLE ON THE MARKET. AMONG THEM, THIS INTRODUCTORY BOOK FOCUSES ON THE C2000 LAUNCHPAD™ FAMILY FROM TEXAS INSTRUMENTS™ TO PROVIDE THE READER BASIC PROGRAMMING STRATEGIES, IMPLEMENTATION GUIDELINES AND HARDWARE CONSIDERATIONS FOR SOME POWER ELECTRONICS-BASED CONTROL APPLICATIONS. STARTING FROM SIMPLE EXAMPLES SUCH AS TURNING ON/OFF ON-BOARD LEDs, ANALOG-TO-DIGITAL CONVERSION, WAVEFORM GENERATION, OR HOW A PULSE-WIDTH-MODULATION PERIPHERAL SHOULD BE MANAGED, THE READER IS GUIDED THROUGH THE SETTINGS OF THE SPECIFIC MCU-RELATED SIMULINK® BLOCKS ENABLED FOR CODE TRANSLATION. THEN, THE BOOK PROPOSES SEVERAL CONTROL PROBLEMS IN TERMS OF POWER MANAGEMENT OF RL AND RLC LOADS (E.G., INVOLVING DC-DC CONVERTERS) AND CLOSED-LOOP CONTROL OF DC MOTORS. THE CONTROL SCHEMES ARE INVESTIGATED AS WELL AS THE WORKING PRINCIPLES OF POWER CONVERTER TOPOLOGIES NEEDED TO DRIVE THE SYSTEMS UNDER INVESTIGATION. FINALLY, A COUPLE OF EXERCISES ARE PROPOSED TO CHECK THE READER’S UNDERSTANDING WHILE PRESENTING A PROCESSOR-IN-THE LOOP (PIL) TECHNIQUE TO EITHER EMULATE THE DYNAMICS OF COMPLEX SYSTEMS OR TESTING COMPUTATIONAL PERFORMANCE. THUS, THIS BOOK IS ORIENTED TO GRADUATE STUDENTS OF ELECTRICAL AND AUTOMATION AND CONTROL ENGINEERING PURSUING A CURRICULUM IN POWER ELECTRONICS AND DRIVES, AS WELL AS TO ENGINEERS AND RESEARCHERS WHO WANT TO DEEPEN THEIR KNOWLEDGE AND ACQUIRE NEW COMPETENCES IN THE DESIGN AND IMPLEMENTATIONS OF CONTROL SCHEMES AIMED TO THE AFOREMENTIONED APPLICATION FIELDS. INDEED, IT IS ASSUMED THAT THE READER IS WELL ACQUAINTED WITH FUNDAMENTALS OF ELECTRICAL MACHINES AND POWER ELECTRONICS, AS WELL AS WITH CONTINUOUS-TIME MODELING STRATEGIES AND LINEAR CONTROL TECHNIQUES. IN ADDITION, FAMILIARITY WITH SAMPLED-DATA, DISCRETE-TIME SYSTEM ANALYSIS AND EMBEDDED DESIGN TOPICS IS A PLUS. HOWEVER, EVEN IF THESE COMPETENCES ARE HELPFUL, THEY ARE NOT ESSENTIAL, SINCE THIS BOOK PROVIDES SOME BASIC KNOWLEDGE EVEN TO WHOM IS APPROACHING THESE TOPICS FOR THE FIRST TIME. KEY CONCEPTS ARE DEVELOPED FROM SCRATCH, INCLUDING A BRIEF REVIEW OF CONTROL THEORY AND MODELING STRATEGIES FOR POWER ELECTRONIC-BASED SYSTEMS.**

**MULTIPHYSICS SIMULATION BY DESIGN FOR ELECTRICAL MACHINES, POWER ELECTRONICS AND DRIVES**
**DR. MARIUS ROSU 2017-11-20**
**PRESENTS APPLIED THEORY AND ADVANCED SIMULATION TECHNIQUES FOR ELECTRIC MACHINES AND DRIVES THIS BOOK COMBINES THE KNOWLEDGE OF EXPERTS FROM BOTH ACADEMIA AND THE SOFTWARE INDUSTRY TO PRESENT THEORIES OF MULTIPHYSICS SIMULATION BY DESIGN FOR ELECTRICAL MACHINES, POWER ELECTRONICS, AND DRIVES. THE COMPREHENSIVE DESIGN APPROACH DESCRIBED WITHIN SUPPORTS NEW APPLICATIONS REQUIRED BY TECHNOLOGIES SUSTAINING HIGH DRIVE EFFICIENCY. THE HIGHLIGHTED FRAMEWORK CONSIDERS THE ELECTRIC MACHINE AT THE HEART OF THE ENTIRE ELECTRIC DRIVE. THE BOOK ALSO EMPHASIZES THE SIMULATION BY DESIGN CONCEPT—A CONCEPT THAT FRAMES THE ENTIRE HIGHLIGHTED DESIGN METHODOLOGY, WHICH IS DESCRIBED AND ILLUSTRATED BY VARIOUS ADVANCED SIMULATION TECHNOLOGIES. MULTIPHYSICS SIMULATION BY DESIGN FOR ELECTRICAL MACHINES, POWER ELECTRONICS AND DRIVES BEGINS WITH THE BASICS OF ELECTRICAL MACHINE DESIGN AND MANUFACTURING TOLERANCES. IT ALSO DISCUSSES FUNDAMENTAL ASPECTS OF THE STATE OF THE ART DESIGN PROCESS AND INCLUDES EXAMPLES FROM INDUSTRIAL PRACTICE. IT EXPLAINS FEM-BASED ANALYSIS TECHNIQUES FOR ELECTRICAL MACHINE DESIGN—PROVIDING DETAILS ON HOW IT CAN BE EMPLOYED IN ANSYS MAXWELL SOFTWARE. IN ADDITION, THE BOOK COVERS ADVANCED MAGNETIC MATERIAL MODELING CAPABILITIES EMPLOYED IN NUMERICAL COMPUTATION; THERMAL ANALYSIS; AUTOMATED OPTIMIZATION FOR ELECTRIC MACHINES; AND POWER ELECTRONICS AND DRIVE SYSTEMS. THIS VALUABLE RESOURCE: DELIVERS THE MULTI-PHYSICS KNOW-HOW BASED ON PRACTICAL ELECTRIC MACHINE DESIGN METHODOLOGIES PROVIDES AN EXTENSIVE OVERVIEW OF ELECTRIC MACHINE DESIGN OPTIMIZATION AND ITS INTEGRATION WITH POWER ELECTRONICS AND DRIVES INCORPORATES CASE STUDIES FROM INDUSTRIAL PRACTICE AND RESEARCH AND DEVELOPMENT PROJECTS MULTIPHYSICS SIMULATION BY DESIGN FOR ELECTRICAL MACHINES, POWER ELECTRONICS AND DRIVES IS AN INCREDIBLY HELPFUL BOOK FOR DESIGN ENGINEERS, APPLICATION AND SYSTEM ENGINEERS, AND TECHNICAL PROFESSIONALS. IT WILL ALSO BENEFIT GRADUATE ENGINEERING STUDENTS WITH A STRONG INTEREST IN ELECTRIC MACHINES AND DRIVES.**

***PRINCIPLES OF OBJECT-ORIENTED MODELING AND SIMULATION WITH MODELICA 2.1***
**PETER FRITZSON 2010-08-31**
**PROVIDES AN INTRODUCTION TO MODERN OBJECT-ORIENTED DESIGN PRINCIPLES AND APPLICATIONS FOR THE FAST-GROWING AREA OF MODELING AND SIMULATION COVERS THE TOPIC OF MULTI-DOMAIN SYSTEM MODELING AND DESIGN WITH APPLICATIONS THAT HAVE COMPONENTS FROM SEVERAL AREAS SERVES AS A REFERENCE FOR THE MODELICA LANGUAGE AS WELL AS A COMPREHENSIVE OVERVIEW OF APPLICATION MODEL LIBRARIES FOR A NUMBER OF APPLICATION DOMAINS**
**MATLAB FOR ENGINEERS HOLLY MOORE 2011-07-28**
**THIS IS A VALUE PACK OF MATLAB FOR ENGINEERS: INTERNATIONAL VERSIONAND MATLAB 9 SIMULINK STUDENT VERSION 2011a**
**GAS TURBINES MODELING, SIMULATION, AND CONTROL**
**HAMID ASGARI 2015-10-16**
**GAS TURBINES MODELING, SIMULATION, AND CONTROL: USING ARTIFICIAL NEURAL NETWORKS PROVIDES NEW APPROACHES AND NOVEL SOLUTIONS TO THE MODELING, SIMULATION, AND CONTROL OF GAS TURBINES (GTs) USING ARTIFICIAL NEURAL NETWORKS (ANNS). AFTER DELIVERING A BRIEF INTRODUCTION TO GT PERFORMANCE AND CLASSIFICATION, THE BOOK:OUTLINES IMPORTANT CRITERIA TO CONSIDER**
**SYSTEM DESIGN, MODELING, AND SIMULATION USING PTOLEMY III**
**CLAUDIUS PTOLEMAEUS 2013-09-27**
**THIS BOOK IS A DEFINITIVE INTRODUCTION TO MODELS OF COMPUTATION FOR THE DESIGN OF COMPLEX, HETEROGENEOUS SYSTEMS. IT HAS A PARTICULAR FOCUS ON CYBER-PHYSICAL SYSTEMS, WHICH INTEGRATE COMPUTING, NETWORKING, AND PHYSICAL DYNAMICS. THE BOOK CAPTURES MORE THAN TWENTY YEARS OF EXPERIENCE IN THE PTOLEMY PROJECT AT UC BERKELEY, WHICH PIONEERED MANY DESIGN, MODELING, AND SIMULATION TECHNIQUES THAT ARE NOW IN WIDESPREAD USE. ALL OF THE METHODS COVERED IN THE BOOK ARE REALIZED IN THE OPEN SOURCE PTOLEMY II MODELING FRAMEWORK AND ARE AVAILABLE FOR EXPERIMENTATION THROUGH LINKS PROVIDED IN THE BOOK. THE BOOK IS SUITABLE FOR ENGINEERS, SCIENTISTS, RESEARCHERS, AND MANAGERS WHO WISH TO UNDERSTAND THE RICH POSSIBILITIES OFFERED BY MODERN MODELING TECHNIQUES. THE GOAL OF THE BOOK IS TO EQUIP THE READER WITH A BREADTH OF EXPERIENCE THAT WILL HELP IN UNDERSTANDING THE ROLE THAT SUCH TECHNIQUES CAN PLAY IN DESIGN.**

**EMBEDDED SYSTEM DESIGN**
**PETER MARWEDDEL 2010-11-16**
**UNTIL THE LATE 1980s, INFORMATION PROCESSING WAS ASSOCIATED WITH LARGE MAINFRAME COMPUTERS AND HUGE TAPE DRIVES. DURING THE 1990s, THIS TREND SHIFTED TOWARD INFORMATION PROCESSING WITH PERSONAL COMPUTERS, OR PCs. THE TREND TOWARD MINIATURIZATION CONTINUES AND IN THE FUTURE THE MAJORITY OF INFORMATION PROCESSING SYSTEMS WILL BE SMALL MOBILE COMPUTERS, MANY OF WHICH WILL BE EMBEDDED INTO LARGER PRODUCTS AND INTERFACED TO THE PHYSICAL ENVIRONMENT.**

Hence, these kinds of systems are called embedded systems. Embedded systems together with their physical environment are called cyber-physical systems. Examples include systems such as transportation and fabrication equipment. It is expected that the total market volume of embedded systems will be significantly larger than that of traditional information processing systems such as PCs and mainframes. Embedded systems share a number of common characteristics. For example, they must be dependable, efficient, meet real-time constraints and require customized user interfaces (instead of generic keyboard and mouse interfaces). Therefore, it makes sense to consider common principles of embedded system design. Embedded system design starts with an introduction into the area and a survey of specification models and languages for embedded and cyber-physical systems. It provides a brief overview of hardware devices used for such systems and presents the essentials of system software for embedded systems, like real-time operating systems. The book also discusses evaluation and validation techniques for embedded systems. Furthermore, the book presents an overview of techniques for mapping applications to execution platforms. Due to the importance of resource efficiency, the book also contains a selected set of optimization techniques for embedded systems, including special compilation techniques. The book closes with a brief survey on testing. Embedded system design can be used as a text book for courses on embedded systems and as a source which provides pointers to relevant material in the area for PhD students and teachers. It assumes a basic knowledge of information processing hardware and software. Courseware related to this book is available at <http://ls12-www.cs.tu-dortmund.de/~marwedel>.

**Advances in Applied Mechanical Engineering** Hari Kumar Voruganti 2020-02-01 This book presents select peer reviewed proceedings of the International Conference on Applied Mechanical Engineering Research (ICAMER 2019). The book examines various areas of mechanical engineering namely design, thermal, materials, manufacturing and industrial engineering covering topics like FEA, optimization, vibrations, condition monitoring, tribology, CFD, IC engines, turbo-machines, automobiles, manufacturing processes, machining, CAM, additive manufacturing, modelling and simulation of manufacturing processing, optimization of manufacturing processing, supply chain management, and operations management. In addition, recent studies on composite materials, materials characterization, fracture and fatigue, advanced materials, energy storage, green building, phase change materials and structural change monitoring are also covered. Given the contents, this book will be useful for students, researchers and professionals working in mechanical engineering and allied fields.

**Semiconductor Power Devices** Josef Lutz 2018-02-16 Halbleiter-Leistungsbaulemente sind das Kernstück der Leistungselektronik. Sie bestimmen die Leistungsfähigkeit und machen neuartige und verlustarme Schaltungen erst möglich. In dem Band wird neben den Halbleiter-Leistungsbaulementen selbst auch die Aufbau- und Verbindungstechnik behandelt: von den physikalischen Grundlagen und der Herstellungstechnologie über einzelne Bauelemente bis zu thermomechanischen Problemen, Zerstörungsmechanismen und Störungseffekten. Die 2., überarbeitete Auflage berücksichtigt technische Neuerungen und Entwicklungen.

**PID and Predictive Control of Electrical Drives and Power Converters using MATLAB / Simulink** Liuping Wang 2014-12-17 A timely introduction to current research on PID and predictive control by one of the leading authors on this subject. PID and Predictive Control of Electric Drives and Power Supplies using MATLAB/Simulink examines the classical control system strategies, such as PID control, feed-forward control and cascade control, which are widely used in current practice. The authors share their experiences in actual design and implementation of the control systems on laboratory test-beds, taking the reader from the fundamentals through to more sophisticated design and analysis. The book contains sections on closed-loop performance analysis in both frequency domain and time domain, presented to help the designer in selection of controller parameters and validation of the control system. Continuous-time model predictive control systems are designed for the drives and power supplies, and operational constraints are imposed in the design. Discrete-time model predictive control systems are designed based on the discretization of the physical models, which will

appeal to readers who are more familiar with sampled-data control systems. Soft sensors and observers will be discussed for low cost implementation. Resonant control of the electric drives and power supply will be discussed to deal with the problems of bias in sensors and unbalanced three phase AC currents. Brings together both classical control systems and predictive control systems in a logical style from introductory through to advanced levels. Demonstrates how simulation and experimental results are used to support theoretical analysis and the proposed design algorithms. MATLAB and Simulink tutorials are given in each chapter to show the readers how to take the theory to applications. Includes MATLAB and Simulink software using xPC Target for teaching purposes. A companion website is available. Researchers and industrial engineers; and graduate students on electrical engineering courses will find this a valuable resource.

**Internal Combustion Engines and Powertrain Systems for Future Transport 2019** IMECHE 2020-03-23 With the changing landscape of the transport sector, there are also alternative powertrain systems on offer that can run independently of or in conjunction with the internal combustion (IC) engine. This shift has actually helped the industry gain traction with the IC engine market projected to grow at 4.67% CAGR during the forecast period 2019-2025. It continues to meet both requirements and challenges through continual technology advancement and innovation from the latest research. With this in mind, the contributions in Internal Combustion Engines and Powertrain Systems for Future Transport 2019 not only cover the particular issues for the IC engine market but also reflect the impact of alternative powertrains on the propulsion industry. The main topics include: • Engines for hybrid powertrains and electrification • IC engines • Fuel cells • E-machines • Air-path and other technologies achieving performance and fuel economy benefits • Advances and improvements in combustion and ignition systems • Emissions regulation and their control by engine and after-treatment • Developments in real-world driving cycles • Advanced boosting systems • Connected powertrains (AI) • Electrification opportunities • Energy conversion and recovery systems • Modified or novel engine cycles • IC engines for heavy duty and off highway Internal Combustion Engines and Powertrain Systems for Future Transport 2019 provides a forum for IC engine, fuels and powertrain experts, and looks closely at developments in powertrain technology required to meet the demands of the low carbon economy and global competition in all sectors of the transportation, off-highway and stationary power industries.

**Motor Vehicle** T. K. Garrett 2000-12-18 "As a reference book it has to be classed as one of the best! There should be a copy of it in every college library." Association of Motor Vehicle Teachers' Newsletter The Motor Vehicle has been an essential reference work for both the student and practising engineer ever since the first edition appeared in 1929. Today it is as indispensable to anyone with a serious interest in vehicle design techniques, systems and construction as it was then. The current edition has undergone a major revision to include seven new chapters. These include Electric Propulsion; covering all aspects from lead acid and alternative batteries to fuel cells and hybrid vehicles, static and dynamic safety, and wheels and tyres. The chapter on the compression ignition engine has been expanded to form three chapters, concentrating on aspects such as common rail injection, recently developed distributor type pumps and electronic control of injection. Automatic, semi-automatic and continuously variable ratio transmissions are covered in two new chapters. A third contains information on the latest developments in computer-aided control over both braking and traction, for improving vehicle stability, while another contains entirely new information on the practice and principles of electrically-actuated power-assisted steering. Also included is coverage of material detailing the latest knowledge and practice relating to safety systems, vehicle integrity, braking systems and much more. The established layout of the book is retained, with topics relating to the engine, transmission and carriage unit dealt with in turn. Each chapter is well-provided with diagrams, sections, schematics and photographs, all of which contribute to a clear and concise exposition of the material under discussion. Latest extensive revisions to a well-established title. New chapters on electric propulsion and vehicle safety.