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Like a satellite tracker or moon tracker, it tracks the celestial object in the sky on its orbital path of apparent movement. A 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. 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. 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. 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 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++, 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, FUJII 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 NI PXI OR NI cRIO, PIC PROCESSOR, INTEL 8051/8085, IBM (CELL, POWER, BRAIN OR TRUENORTH SERIES), FPGA (XILINX ALTERA NIOS), XEON, ATMEL MEGA AVR, 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 ENERGY AND CONCENTRATED SOLAR DEVICES, INCLUDING 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 POLYGENERATION, SOLAR TRIGENERATION (SOLAR TRIPLE GENERATION), AND SOLAR QUAD GENERATION (ADDING DELIVERY OF STEAM, LIQUID/GASEOUS FUEL, OR CAPTURE FOOD-GRADE CO₂) 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 (CCHP, 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 AND SIMULINK 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 ALLOW 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 ANTENNA. 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 PHOTOSENSORS 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 WIIMOTE 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 ROBOTICS 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 FOCUSES 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

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. 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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, FUJII 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 NI PXI OR NI cRIO, PIC PROCESSOR, INTEL 8051/8085, IBM (CELL, POWER, BRAIN OR TRUENORTH 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 POLYGENERATION, SOLAR TRIGENERATION (SOLAR TRIPLE GENERATION), AND SOLAR QUAD GENERATION (ADDING DELIVERY OF STEAM, LIQUID/GASEOUS FUEL, OR CAPTURE FOOD-GRADE CO₂) 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 (CCHP, 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 WIIMOTE 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.

Tracking-Systems, Solar-Tracker Systems.

[illegible]

STORAGE OF ELECTRICAL, HEAT AND COOLING ENERGIES IN LAYERS. EACH LAYER HAS ITS OWN SET OF SMART MICROGRID PRIORITIES ASSOCIATED WITH USER DEMAND SIDE CYCLE PREDICTIONS. MIXED INTEGER LINEAR PROGRAMMING AND NEURAL NETWORK ALGORITHMS ARE BEING MODELED TO PERFORM MULTI OBJECTIVE CONTROL OPTIMIZATION AS POTENTIAL OPTIMIZATION AND ADAPTIVE LEARNING TECHNIQUES.


Automatic Solar Tracking Sun Tracking Satellite Tracking rastreador solar seguimiento solar seguidor solar automatico de seguimiento solar ERRO PRINSLOO, ROBERT DOBSON, 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 AUTOMATICO, AUTOMATICO SEGUIDOR SOLAR, INSEGUIMENTO SOLARE, INSEGUITORE SOLARE, ENERGIA TERMICA, SOLE SEGUITO, 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 APPLET 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 APPLET, 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, FUJII 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 NI PXI OR NI cRIO, PIC PROCESSOR, INTEL 8051/8085, IBM (CELL, POWER, BRAIN OR TRUENORTH 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 POLYGENERATION, SOLAR TRIGENERATION (SOLAR TRIPLE GENERATION), AND SOLAR QUAD GENERATION (ADDING DELIVERY OF STEAM, LIQUID/GASEOUS FUEL, OR CAPTURE FOOD-GRADE CO₂) 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 (CCHP, 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 WIIMOTE 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.

 **VOX POLITICAL: STRONG WORDS AND HARD TIMES** MIKE SIVIER, 2013-07-18 ALWAYS IRREVERENT, OFTEN SCATHING, VOX POLITICAL HAS BEEN COMMENTING ON THE UK POLITICAL SCENE SINCE LATE 2011. STRONG WORDS AND HARD TIMES COLLECTS THE BEST ARTICLES OF 2012 INTO A HANDY VOLUME, PROVIDING GUIDANCE AND INSIGHT INTO THE FACTS BEHIND THE RHETORIC - IN A WAY THAT EVERYONE CAN UNDERSTAND.

YEAH, REVIEWING A BOOK **PAGE 11.HTM** COULD BUILD UP YOUR CLOSE FRIENDS LISTINGS. THIS IS JUST ONE OF THE SOLUTIONS FOR YOU TO BE SUCCESSFUL. AS UNDERSTOOD, TALENT DOES NOT RECOMMEND THAT YOU HAVE WONDERFUL POINTS.

COMPREHENDING AS CAPABLY AS SETTLEMENT EVEN MORE THAN OTHER WILL PROVIDE EACH SUCCESS. NEXT-DOOR TO, THE REVELATION AS WELL AS INSIGHT OF THIS **PAGE 11.HTM** CAN BE TAKEN AS WELL AS PICKED TO ACT.

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UNLIMITED OR SCRIBD OFFER SUBSCRIPTION-BASED ACCESS TO A WIDE RANGE OF PAGE11.HTM EBOOKS, INCLUDING SOME POPULAR TITLES.

FAQs ABOUT PAGE11.HTM BOOKS

HOW DO I KNOW WHICH EBOOK PLATFORM IS THE BEST FOR ME? FINDING THE BEST EBOOK PLATFORM DEPENDS ON YOUR READING PREFERENCES AND DEVICE COMPATIBILITY. RESEARCH DIFFERENT PLATFORMS, READ USER REVIEWS, AND EXPLORE THEIR FEATURES BEFORE MAKING A CHOICE. ARE FREE EBOOKS OF GOOD QUALITY? YES, MANY REPUTABLE PLATFORMS OFFER HIGH-QUALITY FREE EBOOKS, INCLUDING CLASSICS AND PUBLIC DOMAIN WORKS. HOWEVER, MAKE SURE TO VERIFY THE SOURCE TO ENSURE THE EBOOK CREDIBILITY. CAN I READ EBOOKS WITHOUT AN EREADER? ABSOLUTELY! MOST EBOOK PLATFORMS OFFER WEBBASED READERS OR MOBILE APPS THAT ALLOW YOU TO READ EBOOKS ON YOUR COMPUTER, TABLET, OR SMARTPHONE. HOW DO I AVOID DIGITAL EYE STRAIN WHILE READING EBOOKS? TO PREVENT DIGITAL EYE STRAIN, TAKE REGULAR BREAKS, ADJUST THE FONT SIZE AND BACKGROUND COLOR, AND ENSURE PROPER LIGHTING WHILE READING EBOOKS. WHAT THE ADVANTAGE OF INTERACTIVE EBOOKS? INTERACTIVE EBOOKS INCORPORATE MULTIMEDIA ELEMENTS, QUIZZES, AND ACTIVITIES, ENHANCING THE READER ENGAGEMENT AND PROVIDING A MORE IMMERSIVE LEARNING EXPERIENCE. PAGE11.HTM IS ONE OF THE BEST BOOK IN OUR LIBRARY FOR FREE TRIAL. WE PROVIDE COPY OF PAGE11.HTM IN DIGITAL FORMAT, SO THE RESOURCES THAT YOU FIND ARE RELIABLE. THERE ARE ALSO MANY EBOOKS OF RELATED WITH PAGE11.HTM. WHERE TO DOWNLOAD PAGE11.HTM ONLINE FOR FREE? ARE YOU LOOKING FOR PAGE11.HTM PDF? THIS IS DEFINITELY GOING TO SAVE YOU TIME AND CASH IN SOMETHING YOU SHOULD THINK ABOUT. IF YOU TRYING TO FIND THEN SEARCH AROUND FOR ONLINE. WITHOUT A DOUBT THERE ARE NUMEROUS THESE AVAILABLE AND MANY OF THEM HAVE THE FREEDOM. HOWEVER WITHOUT DOUBT YOU RECEIVE WHATEVER YOU PURCHASE. AN ALTERNATE WAY TO GET IDEAS IS ALWAYS TO CHECK ANOTHER PAGE11.HTM. THIS METHOD FOR SEE EXACTLY WHAT MAY BE INCLUDED AND ADOPT THESE IDEAS TO YOUR BOOK. THIS SITE WILL ALMOST CERTAINLY HELP YOU SAVE TIME AND EFFORT, MONEY AND STRESS. IF YOU ARE LOOKING FOR FREE BOOKS THEN YOU REALLY SHOULD CONSIDER FINDING TO ASSIST YOU TRY THIS. SEVERAL OF PAGE11.HTM ARE FOR SALE TO FREE WHILE SOME ARE PAYABLE. IF YOU ARENT SURE IF THE BOOKS YOU WOULD LIKE TO DOWNLOAD WORKS WITH FOR USAGE ALONG WITH YOUR COMPUTER, IT IS POSSIBLE TO DOWNLOAD FREE TRIALS. THE FREE GUIDES MAKE IT EASY FOR SOMEONE TO FREE ACCESS ONLINE LIBRARY FOR DOWNLOAD BOOKS TO YOUR DEVICE. YOU CAN GET FREE DOWNLOAD ON FREE TRIAL FOR LOTS OF BOOKS CATEGORIES. OUR LIBRARY IS THE BIGGEST OF THESE THAT HAVE LITERALLY HUNDREDS OF THOUSANDS OF DIFFERENT PRODUCTS CATEGORIES REPRESENTED. YOU WILL ALSO SEE THAT THERE ARE SPECIFIC SITES CATERED TO DIFFERENT PRODUCT TYPES OR CATEGORIES, BRANDS OR NICHES RELATED WITH PAGE11.HTM. SO DEPENDING ON WHAT

EXACTLY YOU ARE SEARCHING, YOU WILL BE ABLE TO CHOOSE E BOOKS TO SUIT YOUR OWN NEED. NEED TO ACCESS COMPLETELY FOR CAMPBELL BIOLOGY SEVENTH EDITION BOOK? ACCESS EBOOK WITHOUT ANY DIGGING. AND BY HAVING ACCESS TO OUR EBOOK ONLINE OR BY STORING IT ON YOUR COMPUTER, YOU HAVE CONVENIENT ANSWERS WITH PAGE11.HTM To GET STARTED FINDING PAGE11.HTM, YOU ARE RIGHT TO FIND OUR WEBSITE WHICH HAS A COMPREHENSIVE COLLECTION OF BOOKS ONLINE. OUR LIBRARY IS THE BIGGEST OF THESE THAT HAVE LITERALLY HUNDREDS OF THOUSANDS OF DIFFERENT PRODUCTS REPRESENTED. YOU WILL ALSO SEE THAT THERE ARE SPECIFIC SITES CATERED TO DIFFERENT CATEGORIES OR NICHEs RELATED WITH PAGE11.HTM So DEPENDING ON WHAT EXACTLY YOU ARE SEARCHING, YOU WILL BE ABLE TO CHOOSE EBOOK TO SUIT YOUR OWN NEED. THANK YOU FOR READING PAGE11.HTM. MAYBE YOU HAVE KNOWLEDGE THAT, PEOPLE HAVE SEARCH NUMEROUS TIMES FOR THEIR FAVORITE READINGS LIKE THIS PAGE11.HTM, BUT END UP IN HARMFUL DOWNLOADS. RATHER THAN READING A GOOD BOOK WITH A CUP OF COFFEE IN THE AFTERNOON, INSTEAD THEY JUGGLED WITH SOME HARMFUL BUGS INSIDE THEIR LAPTOP. PAGE11.HTM IS AVAILABLE IN OUR BOOK COLLECTION AN ONLINE ACCESS TO IT IS SET AS PUBLIC SO YOU CAN DOWNLOAD IT INSTANTLY. OUR DIGITAL LIBRARY SPANS IN MULTIPLE LOCATIONS, ALLOWING YOU TO GET THE MOST LESS LATENCY TIME TO DOWNLOAD ANY OF OUR BOOKS LIKE THIS ONE. MERELY SAID, PAGE11.HTM IS UNIVERSALLY COMPATIBLE WITH ANY DEVICES TO READ.

PAGE11.HTM :

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WEB EXAM TIME TABLE SUMMER 2023 WINTER 2023
ARCHIVE CURRENT S2023 W2023 EXAM SEM SEM LAST
UPDATED ON

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WEB DIPLOMA ENGINEERING EXAM TIME TABLE 5TH SEM 1
DIPLOMA ENGINEERING EXAM TIME TABLE 5TH SEM GTU
DIPLOMA EXAM TIME TABLE 2020 WINTER ODD 1ST 3RD 5TH
NCEES FE EXAM INFORMATION DIPLOMA ENGINEERING EXAM TIME
TABLE RGPV TIME TABLE 2020 21 GET UG PG DIPLOMA B
TECH M TECH MSBTE TIME TABLE EXAMINATION SCHEDULE

**BTER DIPLOMA EXAM SCHEDULE 2023 TIME TABLE 1ST YEAR
3RD 4TH 5TH - MAY 18 2022**

WEB CHECK BTER ENGINEERING DIPLOMA EXAM TIME TABLE DATE
SHEET 2023 1ST 2ND SEM 3RD 4TH SEM 5TH 6TH YEAR
FROM THE OFFICIAL WEBSITE BY FOLLOWING THESE STEPS
VISIT OFFICIAL ON LINE WEB PORTAL TECHEDU RAJASTHAN
GOV IN

**TIME TABLE FOR WINTER 2023 THEORY EXAMINATION - MAY
30 2023**

WEB THE DURATION OF WINTER 2023 EXAMINATION IS 18
DAYS ALL STUDENTS BELONGING TO OLD SCHEMES SHALL
NOTE THAT THE THEORY EXAMINATION SHALL BE AS PER THE
PAPER CODES WHICH ARE OFFERED AS EQUIVALENT TO THE
COURSES IN OLD SCHEMES INDICATED ON THEIR HALL TICKET

SBTET DIPLOMA EXAM TIME TABLE 2023 FOR 1ST 2ND 3RD
4TH 5TH - MAR 16 2022

WEB SBTET DIPLOMA EXAM TIME TABLE 2023 FOR 1ST 2ND
3RD 4TH 5TH 6TH 7TH SEMESTER WISE DETAILS DIPLOMA
POLYTECHNIC EXAM TIME TABLE 2023 DATE SHEET FOR
DIPLOMA C09 C15 C08 C05 C14 ER91 COURSES VERY
SOON FOR ALL 1ST 2ND 3RD 4TH 5TH 6TH 7TH SEMESTER
STATE BOARD OF TECHNICAL EDUCATION TIME TABLE ARE
GIVEN BELOW IN THE INDEXED FORMAT

**MSBTE TIME TABLE 2023 WINTER RELEASED DIPLOMA EXAM -
JUN 30 2023**

WEB OCTOBER 30 2023 BY PURVI MSBTE TIME TABLE 2023
WINTER SUMMER EXAM HAS BEEN RELEASED AT ONLINE MSBTE
CO IN AND MSBTE ORG IN STUDENTS CHECK MSBTE DIPLOMA D
PHARMACY SUMMER WINTER WINTER TIME TABLE 2023 24
FOR 1ST 2ND 3RD 4TH 5TH 6TH SEMESTER MAIN AND
SUPPLEMENTARY EXAMINATION

**DTE KARNATAKA TIME TABLE 2023 OUT DIPLOMA SEMESTER
EXAM TIME TABLE - AUG 21 2022**

WEB SEP 12 2023 DTE KARNATAKA DIPLOMA TIME TABLE
2023 DTE KAR NIC IN 1ST 2ND 3RD 4TH 5TH 6TH SEMESTER
EXAM TIME TABLE ONLINE THIS IS TO NOTIFY EVERY STUDENTS
THAT DEPARTMENT OF TECHNICAL ENGINEERING KARNATAKA
HAS RECENTLY RELEASED THE EXAMINATION ROUTINE 2023
ON ITS OFFICIAL WEBSITE IN AN ONLINE MODE

**MSBTE TIME TABLE WINTER 2023 DIPLOMA 1ST 3RD 5TH
ODD SEMESTER EXAM - NOV 23 2022**

WEB MSBTE TIME TABLE WINTER 2023 DOWNLOAD DIPLOMA
1ST 3RD 5TH SEM EXAM DATE 2023 MAHARASHTRA
DIPLOMA EXAM DATE IS RELEASED BY THE MAHARASHTRA
STATE BOARD OF TECHNICAL EDUCATION FOR THE ODD
SEMESTER POLYTECHNIC EXAMS THE MAHARASHTRA DIPLOMA
EXAM TIME TABLE WILL BE RELEASED IN THE MONTH OF
OCTOBER

*EXAMINATION TIME TABLE CHHATTISGARH SWAMI VIVEKANAND
- FEB 24 2023*

WEB EXAMINATION TIME TABLE BACHELOR OF ENGINEERING BE
5TH SEMESTER OLD SCHEME RE REVISED APRIL MAY 2023 NEW
BE 1ST 2ND SEMESTER OLD SCHEME RE REVISED APRIL MAY
2023 NEW BE 1ST 2ND SEMESTER NEW SCHEME RE REVISED
APRIL MAY 2023 NEW BE 3RD SEMESTER NEW SCHEME RE
REVISED APRIL MAY 2023

DIPLOMA TIME TABLE 2023 POLYTECHNIC EXAM DATE 1ST
2ND 3RD YEAR - OCT 03 2023

WEB OCT 30 2023 OCTOBER 18 2023 BY BSEB ADMIN
DIPLOMA TIME TABLE 2023 1ST 2ND 3RD 4TH 5TH 6TH
SEMESTER STUDENTS NOW DOWNLOAD DIPLOMA POLYTECHNIC
EXAM DATE 2023 WINTER SUMMER ALL STATE FROM THIS
PAGE THE DIPLOMA BOARD

**DIPLOMA TIME TABLE 2023 POLYTECHNIC SEMESTER EXAM
DATE SHEET - SEP 02 2023**

WEB FEB 1 2023 AND TECHNICAL EDUCATION BOARD OF
STATE RELEASED THE DIPLOMA EXAM SCHEDULE SEMESTER
WISE ODD EVEN THIS TIME ALL BOARDS ARE BUSY
CONDUCTING ODD SEMESTER 1ST 3RD 5TH SEM EXAM AND
EVEN SEMESTER 2ND 4TH 6TH SEM EXAMINATION
POLYTECHNIC DIPLOMA EXAM ORGANIZES BY THE STATE
BOARD TWICE A YEAR

TE KERALA DIPLOMA TIME TABLE 2023 TODAY TEKERALA

ORG - SEP 21 2022

WEB SEP 29 2023 DOWNLOAD TE KERALA DIPLOMA TIME TABLE 2023 FOR 1ST 2ND 3RD 4TH 5TH AND 6TH SEMESTER EXAMINATIONS WHICH ARE GOING TO BE HELD SOON CANDIDATES CAN DOWNLOAD TEKERALA.ORG POLYTECHNIC EXAM TIME TABLE 2023 KERALA DIPLOMA TIME TABLE 2023 FOR S1 S3 AND S5 EXAMS TO BE HELD IN NOVEMBER 2023 IS NOW AVAILABLE TO VIEW HERE AT [MSBTE ACADEMIC CALENDAR 2022 2023 PDF MSBTE NEWS - DEC 25 2022](#)

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WEB OCTOBER 21 2023 BY KSOU OFFICIAL DIPLOMA TIME TABLE 2023 1ST 2ND 3RD 4TH 5TH 6TH SEMESTER WITH THE PASSAGE OF TIME IT HAS BECOME MORE IMPORTANT FOR PEOPLE TO OBTAIN A DEGREE OR DIPLOMA IN ORDER TO MAKE A NAME FOR THEMSELVES

[DIPLOMA IN ENGINEERING EXAM 5TH 7TH AND 8TH SEMESTER RESULT BTB - FEB 12 2022](#)

WEB JAN 28 2013 DIPLOMA IN ENGINEERING UNDER BANGLADESH TECHNICAL EDUCATION BOARD BTB GOV BD 5TH 7TH 8TH REGULAR SEMESTER AND 2ND 4TH 6TH SEMESTER IRREGULAR EXAMINATION WILL BE START ON FEBRUARY 28 2013 HERE THE NOTICE FOR DIPLOMA IN ENGINEERING 2ND 4TH 5TH 6TH 7TH AND 8TH SEMESTER STUDENTS ALSO WE WILL PUBLISH THE

[SBTE BIHAR EXAM DATE 2023 ODD SEM SBTEONLINE IN DIPLOMA TIME TABLE - APR 16 2022](#)

WEB OCT 13 2023 SBTE BIHAR EXAM DATE 2023 ODD SEM PDF DOWNLOAD SBTE BIHAR ONLINE DIPLOMA POLYTECHNIC TIME TABLE 2023 FOR 1ST 2ND 3RD 4TH 5TH 6TH SEMESTER AT SBTEONLINE IN THE STATE BOARD OF TECHNICAL EDUCATION BIHAR RELEASED ODD EVEN SEM EXAM EXAM SCHEDULE ON OFFICIAL WEBSITE

[TIME TABLE FOR SUMMER 2023 THEORY EXAMINATION MSBTE - JAN 26 2023](#)

WEB THE EXAM DAY DATE WISE FINAL TIME TABLE FOR SUMMER 2023 THEORY EXAMINATION IS DISPLAYED ON MSBTE PORTAL FOR THE INFORMATION OF STUDENTS INSTITUTES AND ALL CONCERNED 2 THE DURATION OF SUMMER 2023 THEORY EXAMINATION IS 18 DAYS

[TNDTE DIPLOMA TIME TABLE 2023 ODD EVEN SEM EXAM SCHEDULE GOVT EXAMS - JUL 20 2022](#)

WEB APR 4 2023 TNDTE DIPLOMA TIME TABLE 2023 THE TAMILNADU DTE RELEASE 1ST 3RD 5TH SEMESTER CAN CHECK AND DOWNLOAD DOTE POLYTECHNIC EXAM SCHEDULE 2023 FROM OFFICIAL WEBSITE STUDENTS CAN CHECK SUBJECT WISE DIPLOMA POLYTECHNIC EXAM DATE IN TNDTE DIPLOMA TIME TABLE 2023 AS PER NEWS THE TN DIPLOMA ODD SEM EXAMS WILL STARTED

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