Introduction to mechatronics

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N. Pannaga, N. Ganesh, Ravish Gupta, 2013, Mechatronics - Introduction to Mechatronics, INTERNATIONAL JOURNAL ENGINEERING RESEARCH AND Technology (IJERT) Volume 02, Issue 08 (August 2013), N. PannagaTech Scientist, Department of Mechanics, Visvesvaraya University of Technology, GaneshM. Technical Scientist, Department of Aerospace Motion Technology, Visvesvaraya University of Technology, Ravish GuptaTech Scientist, Department of Electronics and Communications, Rajiv Gandhi Proudyogiki Vishwavidyalaya, AbstractInnovation in today's Industrial System or Industrial Control System (ICS) is often possible only because of the built-in system. In particular, the software connects previously isolated systems, resulting in so-called advanced mechatronic systems. Mechatronics is an interdisciplinary way of combining classical engineering disciplines for engineering and electrical engineering, electronic engineering and computer science. The word Mechatronics consists of mechaf mechanics and tronicsfrom electronics. In other words, the technology and developed products will incorporate electronics more and more into the mechanisms, closely and organically, and makes it impossible to tell where one ends and the other begins. The field of research involving analysis, design, synthesis and selection of systems that combine electronics and mechanical components with modern controls and microprocessorsKeysMechatronics system, Mechatronics Definitions, Mechatronics Design Step, Goals Mechatronics.INTRODUCTIONThe word Mechatronics was first introduced by a senior engineer of the Japanese company, Yaskawa, in 1969. The company received the rights to the trademark at the word in 1971. The word soon gained widespread acceptance in the industry and to allow its free use, Yaskawa decided to give up his right to speak in 1982. Mechatronics systems are made up of components from different physical areas that are closely related and therefore interact with each other. In addition, the behaviour of the components is very non-linear. WHAT IS MECHATRONICS? Today, this means mechatronic engineering activities, including the design, testing and operation of machinery and equipment in which there is a high level of functional integration electronics and computer-controlled systems. Mechatronics is an interdisciplinary area that combines classical engineering, hydraulics, hydraulics, hydraulics, electronics, optics and computer science. A typical mechatronic system picks up signals from the environment, processes them to generate output signals, turning them into, for example, forces, movements and actions. Mechatronics' goal is to improve the functionality of technical systems and create new concepts for machines and equipment with built-in artificial intelligence. Mechatronics provides an opportunity not only to humanize machines, but also changes the mentality and approach to technological issues and, most importantly, learning new technologies and ways to acquire knowledge and skills. The most important feature of mechatronic devices is the ability to accurately process and transmit information in the form of different types of signals (mechanical, electrical, hydraulic, pneumatic, optical, chemical, biological), with a high level of automation of these devices. Figure: - - Mechatronics SystemNowadays many machines and even simple household appliances consist of mechanisms controlled by engines and drives with electric control circuits. The overall control of these machines is provided by programmable components such as PLC, microcontrollers, or even PCs. The main difference between conventional equipment with electronic components and mechatronic equipment is that the former adds electronic components, while the latter integrates electronic components. Adding some electronics to the machine means adding additional features, and integrating electronics means providing enhanced hardware capabilities. Mechatronics DefinitionsMechatronics is a synergistic integration of sensors, drives, signal conditioning, power electronics, decision-making and control algorithms, as well as computer hardware and software to manage complexity, uncertainty and communication in engineering systems. IEEE (Institute of Electrical and Electronics Engineers) and ASME (American Society of Mechanical Engineers) promote the following definition: Mechatronics is a synergistic integration of engineering with electronic control and smart, PC-based control, in the design and manufacture of goods and processes. MechatronicsMechatronics' goals are mainly aimed at improving technical offers, i.e. making machines faster and cheaper to produce. In industry products and processes are developed because of problems and so they are known, and combating them is a kind of simple action where behavior can be predicted, at least in principle. Even there, however, the complexity of images and situations is increasing, which already leads to the use of unconventional tools such as fuzzy control, neural networks, expert systems and their combinations. The drawing showed the mechatronics industry systemMechatronics Design StepMechatronic products are widely used in industry and everyday life. Designing mechatronic products an edict approach that takes into account: interdisciplinary design, design, related limitations, versatility, user-friendly operations, and the requirement to minimize the cost of the entire life of the product. Thus, designers who create mechatronic products must possess comprehensive interdisciplinary knowledge, the ability to collaborate in an interdisciplinary design team, as well as team management skills, and knowledge of how to use the latest computer engineering tools. In addition, the know-how in planning and prototyping of mechatronic systems is very useful. Type of elementsElectromechanical elements: - Sensors, various physical variables can be measured using sensors. Drives, DCservomotor, stepper engine, relay, solenoid, speaker, light-emitting diode (LED), alloy memory form, electromagnet, and pump apply command action on the physical-mesic process. Sensors based on IC and compass drives, potentiometer, etc. Rice: - - Mechatronics Design ProcessElectrical elements:-Electric components, such as resistor (R), capacitor (C), inductor (L), transformer, etc. Electronic elements:-Analog/digital electronics, transistors, thyristors, opto-inss, Control interface/computing hardware:-Analog-digital (A2D) converter, Digital to Analog (D2A) converter, digitalinput/output (I/O), counters, timers, microprocessor, microcontroller, dataacquisition and control (DAC) board, and digital signal processing (DSP) boardComputer/Information System:-Computer elements refer to equipment/software used for execution, computer dynamic analysis systems Rapid management prototyping, hardware-in-the-loop modeling, pc-gathering data collection and management Of Mechatronics Elements: -Typical knowledge base for optimal design and operation of Thermo-liquid, tructural, hydraulic, electrical, chemical, biological, etc. theory of decision-making and management, sensors and conditioning of signals, drives and electronics, data acquisition. A2D, D2A, digital i/O, counters, timers etc. Hardware interaction, rapid control prototyping, built-in computing. Balance theory, modeling, hardware and software. Mechatronics is the result of the application of information systems to physical systems. The physical system, the most right-hand dotted unit, consists of mechanical, electrical and computer (electronic) systems, as well as drives, sensors and real-time interfects. Sensors and drives are used for energy transductions with high power, usually the mechanical side, to the low power, electrical and computer or electronic side. A unit labeled mechanical system rarely consists of more than mechanical components and Include liquid, pneumatic, thermal, acoustic, chemical and other disciplines as well. New research challengesThe interactively collaborating intelligent machines lead to new research topics in mechatronics in other areas as well. It is important that the machine and its components can learn, self-adaptation and self-calibration. Methods such as a combination of neural networks and fuzzy control through expert systems will further emphasize the importance of software. Pic: - MechatronicsMechatronic Engineering is an engineering discipline related to research, design, The introduction and maintenance of intelligent engineering products and processes included in the integration of mechanical, electronic, computer and software engineering technologiesSpecific field expertise may include: Artificial Intelligence TechniquesAvionics Computer Equipment and SystemsData Communications And Network Dynamics Machines and MechanismsElectromagnetic Energy TransformationElectronicEmbedded, Devices and SensorsMechanical Design and Materials , Planning, optimization, and control of the plant and production of SystemsRoboticsSignal ProcessingSignal ProcessingSmart InfrastructureSoftware EngineeringThermofluidsHaptic InterfacesMedicalsAutomationRoboticsControlMechanical VibrationsMechatronics In MedicineIn 1985, the Department of Mechanical Engineering of the Imperial College began research in medical robotics for neurosurgery. Further research of the robot for prostatectomy, starting in 1988, was completed in 1991 in World First with a demonstration of robotic prostate surgery. This robot was the first to actively remove tissue from the patient in the operating room. With the expansion of the use of robotic surgery, the Mechatronics Laboratory in Medicine was established in 1993 as part of the Computer Systems Engineering Section to research and develop mechatronics for surgery. The team developed mechatronic applications in areas as diverse as neurosurgery, magnetic resonance imaging (MRI), compatible robotics, tactile surgeon training systems, urology and orthopedics, high-intensity focused ultrasound and blood tests. New VTEC Applications, Micro Air Vehicles, Piston Pump, Multi Air Engine, Six-Stroke Engine, Solar Cars, Thermo Acoustic Cooling, Biodeisel, Digital Twin Spark Ignition, Nano Included Coverage Makes Aircraft Invisible, Automatic Transmission in Cars, Nitro Shock Absorbers, Hypercar, 3D Machine Vision Systems, Geothermal Energy, Cryogenic Heat Processing, Winged Rocket Technology, Camless Engine Anti-block braking sensors, air muscle, SkyBus technology, Scramjet Pollution less engine, Paper battery, Nano IC Engine, liquid nitrogen, petrol direct injection, Emulsified ethanol, direct injection of diesel engine, vehicle dynamics, Valvetronics, Tidal force, Hovercraft, Infrared treatment and convection treatment, aircraft motion system, running transmission, fuel energizer, GPS and applications, Selective Laser Baker, Flexible Manufacturing, Cryocar, Cylinder deactivation, , the detection of mines using radar bullets, the overall efficiency of equipment, predictive maintenance using thermal imaging, methanol-fueled marine diesel engine, deployment of quality function, quasi turbines, robots in the radioactive environment, sidewinder rockets, smart materials, TransitMixer, solar vehicles, two-stroke engine using cane valves, vacuum braking system, variable valve timing in I.C. 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