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Chapter 1 : Lecture Notes | Elements of Mechanical Design | Mechanical Engineering | MIT OpenCourseW

Educational resources for mechanical design and innovation in mechanisms and robotic systems.

What is Mechanical Design or Machine Design? Machine design or Mechanical Design can lead to the formation of the entirely new machine or it can lead to improvement of the existing machine. Let us see what is machine design. To understand what exactly machine design or mechanical design is let us consider the example of the gear box of the car. The gear box transmits the motion and the power of the engine to the wheels of the vehicle. The gearbox comprises group of gears which are subjected to not only motion but also the load of the vehicle. For the gears to run at desired speeds and take desired loads it is important that they should be designed. During designing various calculations are performed considering desired speeds and loads and finally the gear of particular material and specific dimensions that can take all loads and that can be manufactured at least possible cost giving optimum performance is designed. In similar fashion all the components of the car, including engine, have to be designed so that they optimally meet all the functional requirements at lowest possible cost. This whole process of designing is called as machine design or mechanical design. Machine Design or Mechanical Design can be defined as the process by which resources or energy is converted into useful mechanical forms, or the mechanisms so as to obtain useful output from the machines in the desired form as per the needs of the human beings. Machine design can lead to the formation of the entirely new machine or it can lead to up-gradation or improvement of the existing machine. For instance if the existing gearbox is too heavy or cannot sustain the actual loads, entirely new gearbox can be designed. But if the same gearbox has the potential to lift more loads, it can be upgraded by making certain important changes in its design. Small components of machine on assembling make a big machine, hence the machine as a whole as well as its individual components have to be designed. The knowledge of machine design helps the designers as follows: Machine Design is the application of: It also involves application of other subjects like thermodynamics, electrical theory, hydraulics, engines, turbines, pumps etc. Machine drawing is the integral part of the machine design, since all the components or the machines that have been designed should be drawn to manufacture them as per the specifications. Without machine drawing the subject of machine design is incomplete. Machine Design by Dr. Machine design and drawing are very important subjects of mechanical engineering. No produce can be manufactured without designing it. Here some basic concepts of machine design or mechanical design have been covered.

Chapter 2 : Mechanical engineering - Wikipedia

Mechanical engineering is the discipline that applies engineering, physics, engineering mathematics, and materials science principles to design, analyze, manufacture, and maintain mechanical systems.

Mechanics Mechanics is, in the most general sense, the study of forces and their effect upon matter. Typically, engineering mechanics is used to analyze and predict the acceleration and deformation both elastic and plastic of objects under known forces also called loads or stresses. Subdisciplines of mechanics include Statics , the study of non-moving bodies under known loads, how forces affect static bodies Dynamics the study of how forces affect moving bodies. Dynamics includes kinematics about movement, velocity, and acceleration and kinetics about forces and resulting accelerations. Mechanics of materials , the study of how different materials deform under various types of stress Fluid mechanics , the study of how fluids react to forces [27] Kinematics , the study of the motion of bodies objects and systems groups of objects , while ignoring the forces that cause the motion. Kinematics is often used in the design and analysis of mechanisms. Continuum mechanics , a method of applying mechanics that assumes that objects are continuous rather than discrete Mechanical engineers typically use mechanics in the design or analysis phases of engineering. If the engineering project were the design of a vehicle, statics might be employed to design the frame of the vehicle, in order to evaluate where the stresses will be most intense. Mechanics of materials might be used to choose appropriate materials for the frame and engine. Fluid mechanics might be used to design a ventilation system for the vehicle see HVAC , or to design the intake system for the engine. Mechatronics and robotics[edit] Main articles: Mechatronics and Robotics Mechatronics is a combination of mechanics and electronics. It is an interdisciplinary branch of mechanical engineering, electrical engineering and software engineering that is concerned with integrating electrical and mechanical engineering to create hybrid systems. In this way, machines can be automated through the use of electric motors , servo-mechanisms , and other electrical systems in conjunction with special software. Mechanical systems open and close the drive, spin the CD and move the laser, while an optical system reads the data on the CD and converts it to bits. Integrated software controls the process and communicates the contents of the CD to the computer. Robotics is the application of mechatronics to create robots, which are often used in industry to perform tasks that are dangerous, unpleasant, or repetitive. These robots may be of any shape and size, but all are preprogrammed and interact physically with the world. Robots are used extensively in industrial engineering. They allow businesses to save money on labor, perform tasks that are either too dangerous or too precise for humans to perform them economically, and to ensure better quality. Many companies employ assembly lines of robots, especially in Automotive Industries and some factories are so robotized that they can run by themselves. Outside the factory, robots have been employed in bomb disposal, space exploration , and many other fields. Robots are also sold for various residential applications, from recreation to domestic applications. Structural analysis and Failure analysis Structural analysis is the branch of mechanical engineering and also civil engineering devoted to examining why and how objects fail and to fix the objects and their performance. Structural failures occur in two general modes: Static structural failure occurs when, upon being loaded having a force applied the object being analyzed either breaks or is deformed plastically , depending on the criterion for failure. Fatigue failure occurs when an object fails after a number of repeated loading and unloading cycles. Fatigue failure occurs because of imperfections in the object: Some systems, such as the perforated top sections of some plastic bags, are designed to break. If these systems do not break, failure analysis might be employed to determine the cause. Structural analysis is often used by mechanical engineers after a failure has occurred, or when designing to prevent failure. Engineers often use online documents and books such as those published by ASM [29] to aid them in determining the type of failure and possible causes. Once theory is applied to a mechanical design, physical testing is often performed to verify calculated results. Structural analysis may be used in an office when designing parts, in the field to analyze failed parts, or in laboratories where parts might undergo controlled failure tests. Thermodynamics and thermo-science[edit] Main article: Thermodynamics Thermodynamics is an applied science used in several branches of engineering, including mechanical and

chemical engineering. At its simplest, thermodynamics is the study of energy, its use and transformation through a system. As an example, automotive engines convert chemical energy enthalpy from the fuel into heat, and then into mechanical work that eventually turns the wheels. Thermodynamics principles are used by mechanical engineers in the fields of heat transfer , thermofluids , and energy conversion. Mechanical engineers use thermo-science to design engines and power plants , heating, ventilation, and air-conditioning HVAC systems, heat exchangers , heat sinks , radiators , refrigeration , insulation , and others. Technical drawing and CNC Drafting or technical drawing is the means by which mechanical engineers design products and create instructions for manufacturing parts. A technical drawing can be a computer model or hand-drawn schematic showing all the dimensions necessary to manufacture a part, as well as assembly notes, a list of required materials, and other pertinent information. Drafting has historically been a two-dimensional process, but computer-aided design CAD programs now allow the designer to create in three dimensions. Optionally, an engineer may also manually manufacture a part using the technical drawings. However, with the advent of computer numerically controlled CNC manufacturing, parts can now be fabricated without the need for constant technician input. Manually manufactured parts generally consist spray coatings , surface finishes, and other processes that cannot economically or practically be done by a machine. Drafting is used in nearly every subdiscipline of mechanical engineering, and by many other branches of engineering and architecture. Areas of research[edit] Mechanical engineers are constantly pushing the boundaries of what is physically possible in order to produce safer, cheaper, and more efficient machines and mechanical systems. Some technologies at the cutting edge of mechanical engineering are listed below see also exploratory engineering. Micro electro-mechanical systems MEMS [edit] Micron-scale mechanical components such as springs, gears, fluidic and heat transfer devices are fabricated from a variety of substrate materials such as silicon, glass and polymers like SU8. Examples of MEMS components are the accelerometers that are used as car airbag sensors, modern cell phones, gyroscopes for precise positioning and microfluidic devices used in biomedical applications. Friction stir welding FSW [edit] Main article: The innovative steady state non-fusion welding technique joins materials previously un-weldable, including several aluminum alloys. It plays an important role in the future construction of airplanes, potentially replacing rivets. Current uses of this technology to date include welding the seams of the aluminum main Space Shuttle external tank, Orion Crew Vehicle test article, Boeing Delta II and Delta IV Expendable Launch Vehicles and the SpaceX Falcon 1 rocket, armor plating for amphibious assault ships, and welding the wings and fuselage panels of the new Eclipse aircraft from Eclipse Aviation among an increasingly growing pool of uses.

Chapter 3 : Mechanical Design | White Papers | SOLIDWORKS

Purpose. The Journal of Mechanical Design (JMD) serves the broad design community as the venue for scholarly, archival research in all aspects of the design activity with emphasis on design synthesis.

Chapter 4 : Mechanical Designer Salary | PayScale

This is an advanced course on modeling, design, integration and best practices for use of machine elements such as bearings, springs, gears, cams and mechanisms. Modeling and analysis of these elements is based upon extensive application of physics, mathematics and core mechanical engineering principles (solid mechanics, fluid mechanics.

Chapter 5 : Mechanical Designer Jobs, Employment | calendrierdelascience.com

Mechanical Design or Machine Design is the branch of Engineering Design. Machine design or Mechanical Design can lead to the formation of the entirely new machine or it can lead to improvement of the existing machine.

Chapter 6 : Mechanical Design

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Engineers and designers use mechanical engineering and design software to model, validate, and communicate ideas before production. Additional tools are available and sometimes integrated in the CAD software for manufacturing products on a CNC machine or 3D printer. Mechanical engineering software.

Chapter 7 : 3D Mechanical Engineering And Design Software | Autodesk

Similar mechanical designer jobs include positions such as mechanical technician jobs. Mechanical Designer Educational Requirements A bachelor's degree in industrial product design, commercial art or a related field is typically required to become a Mechanical Designer.

Chapter 8 : Mechanical Design - NuWaves Engineering: Defense Radio Frequency Electronics

Mechanical Design Fundamentals K. Craig 3 Introduction â€¢ Precision machines are essential elements of an industrial society. â€¢ A precision machineis an integrated system that relies on.

Chapter 9 : Mechanical Design

The national average salary for a Mechanical Design Engineer is $66, in United States. Filter by location to see Mechanical Design Engineer salaries in your area. Salary estimates are based on salaries submitted anonymously to Glassdoor by Mechanical Design Engineer employees.