Strength of material

Complex Loading Systems Engineers are normally concerned with the design of components that can serve the purposes for whivh they are created while considering numerous factors including safety which by extension is a factor of the working loads subjected to the designed object. Engineering components are usually subjected to various forces, at the most basic level tensional and compressional forces acting in straight lines. One factor that greatly impacts the nature of loading of a component or structure is the shape of the structure. Yet another factor that impacts the nature of loading is the stresses, deflections and strains that the structure is subjected to. One engineering component may be subjected to strains, stresses and/or torsion at the same time, forces acting at different points according to Melchers and Hough (364). When a system is subjected a myraid of loads of this nature, the system is said to be subjected to complex loads. Some systems that commonly experience complex loading include bridges, building roof structures, differential units and shafts, just to mention a few. Figure 1: showing the structure of a bridge; different components of the bridge subjected to tension, compression, strains and stresses Courtesy http://www. 300thcombatengineersinwwii. com/bridges. html Engineers have always communicated through drawings to convey messages relating to the nature and design of components and structures. In the analysis of engineering structures and components, care is usually taken to avoid failure that results due to several factors including loading and corrossion. The analysis of the forces that act on engineering structures began with the use of drawings, lines and arrows representing forces that were resolved somehow to come up with solutions or results. Superpositioning as a method of analysis has also been employed in analysing engineering components and normally involves the overlapping of forces (Courses. washington p1). In some cases models were developed and analysed or simulated under different and specific conditions. Today, materials are analysed based on design codes developed from probability testing of materials and using powerful computer software. The use of computers and copmuting technology to analyse structures makes it easier to perform dynamic analysis under extreme conditions of loading and to perform time history analysis, a feat that is extremely difficult, almost impossible with manual drawings. Some of the most common software used in the analysis of materials and structures include AutoCAD (for 2D and 3D design, modelling and analysis), LISA (for performing finite element analysis among other functions), CADRE (for analysing various factors of 3D frame and beam type structures), FesaWin (for performing linear stress analysis), Ram-Series (for 2D and 3D structural analyses) (Freebyte par 1-10) and Archicad (for analyzing drawing and analysing architectural designs) among other software. The use of digitised representations of objects makes it easier to analyse objects as the computer has the capapbility to perform complex calculations and therefore execute commends reliably and in real time. Analysing complex objects like the vehicle shown in the figure below would be time consuming, confusing and complex beyond common imagination. Figure 2: Showing a 3D mesh of a model vehicle. Courtesy of : www. directindustry. com Works Cited

Freebyte. Finite Element Analysis. Viewed 8 June, 2011. 2011. Web. http://www. freebyte. com/cad/fea. htm Melchers Robert and Hough Richard. Modeling complex engineering structures. ASCE Publications. 2007. Courses. washington. Structures: Complex Stresses and Deflections. Viewed 8 June, 2011. 2011. Web. http://courses. washington. edu/me354a/chap11. pdf