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Review Article

MODELING AND ANALYSIS OF HAMMER OF IMPACT TESTING MACHINE: A REVIEW

Chandrashekhar J Shende[1]*, A R Sahu[2] and A V Deshmukh[3]

*Corresponding Author: Chandrashekhar J Shende, ✉ cjshende@gmail.com

The Impact Testing Machine is very important for testing and calculating the impact energy required to bent or to break the different types of materials by conducting Charpy and Izod test. The aim of the project is to model, and analyse hammer of Impact Testing Machine. 3-dimensional model of hammer of impact testing machine will be created corresponding to the practical dimensions using PRO-E software and using ANSYS software the analysis of hammer will be done. It will very beneficial for proper use of machine to find out energy require to break or bent the particular type of material in engineering field. Different principles for interaction with users having wide ranges of experiences and knowledge will be discussed. Comprehensive set of packages for modelling, identification, analysis, simulation, and design will be described. Problems associated with structuring, portability, maintainability and extensibility will be discussed.

Keywords: Pro-E Creo-parametric, Ansys workbench, FEM analysis, Simulation

INTRODUCTION

The Impact Testing Machine is very important for testing and calculating the impact energy required to bent or to break the different types of materials by conducting Charpy and Izod test. The aim of the project is to model, Assemble, Drafting and analyze the parts of Impact Testing Machine. 3-dimensional model of impact testing machine is created corresponding to the practical dimensions using PRO-E software and using ANSYS software the analysis of different parts of the machine is done. Use of interactive software for designing, modelling, and analysis of parts of impact testing machine is done for development of Impact Testing Machine. It is very beneficial for proper use in an engineering work. Different principles for interaction with users having wide ranges of experiences and knowledge are discussed. Comprehensive set of packages for modelling, identification, Analysis, simulation, and design are

[1] CAD/CAM, Shri Shankarprasad Agnihotri College of Engg., Wardha.
[2] Mechanical Engg., B.D.C.O.E., Sewagram, Wardha.
[3] Mechanical Engg., Shri Shankarprasad Agnihotri College of Engg, Wardha.

described. Problems associated with structuring, portability, maintainability and extensibility are discussed.

An impact testing machine that constrains relative's motion and reduce friction between moving parts to only the desired motion. Impact testing is of enormous importance. A collision between two objects can often result in damage to one or both of them. The damage might be a scratch, crack, fracture or break. Scientists need to know about how materials and products behave under impact and the magnitude of forces they can resist.

Izod Impact Test Specimens

Izod test specimens vary depending on what material is being tested. Metallic samples tend to be square in cross section, while polymeric test specimens are often rectangular, being struck parallel to the long axis of the rectangle. In the Izod test, the specimen is held on one end and is free on the other end. This way it forms a cantilever beam. Izod test sample usually have a V-notch cut into them, although specimens with no notch as also used on occasion.

Figure 1: Impact Testing Machine

Charpy Impact Test

The principle of the test differs from that of the Izod test in that the test piece is tested as a beam supported at each end; a notch is cut across the middle of one face, and the striker hits the opposite face directly behind the notch. When the results of a number of tests performed in different temperatures are plotted, ductile-to-brittle transition curves, may be obtained. As the temperature is reduced through the transition range, the fracture surface changes from one having a 'fibrous' or 'silky' appearance with much distortion at the sides, to one of completely crystalline appearance with negligible distortion. There is a strong correlation between the energy absorbed and the proportion of the cross-section which suffers deformation in fracture, and the fracture surface is frequently described in terms of the percentage of its area which is crystalline in appearance. Typical fracture appearances with crystallinity increases as the temperature are reduced.

LITERATURE REVIEW

The Charpy impact test, also known as the Charpy V-notch test, is a standardized high strain-rate test which determines the amount of energy absorbed by a material during fracture. This absorbed energy is a measure of a given material's notch toughness and acts as a tool to study temperature-dependent ductile-brittle transition. It is widely applied in industry, since it is easy to prepare and conduct and results can be obtained quickly and cheaply. A disadvantage is that some results are only comparative (Talukdar *et al.*, 2001).

The test was developed around 1900 by S. B. Russell (1898, American) and G. Charpy (1901, French) (Fernandez-Cantelia *et al.*, 2002) The test became known as the Charpy test in the early 1900s due to the technical contributions and standardization efforts by Georges Charpy. The test was pivotal in understanding the fracture problems of ships during WWII (Bimal Kumar Panigrahi and Surendra Kumar Jain, 2002; and Mustafa Ozgur *et al.*, 2008).

Today it is utilized in many industries for testing materials, for example the construction of pressure vessels and bridges to determine how storms will affect the materials used (Bimal Kumar Panigrahi and Surendra Kumar Jain, 2002; and Ajit Roy *et al.*, 2008).

Talukdar *et al*. (2001) studied the effect of fatigue damage in En-8–grade heat treated steel (annealed and hardened and tempered), under different cyclic loading properties. The results indicate higher fracture toughness and impact toughness in hardened-and-tempered steel than in annealed steel. Cyclic hardening and softening occurs in both the hardened-and-tempered as well as the annealed steel. With the increase of peak stress and number of fatigue cycles, the hardened-and-tempered steels. The results are discussed in terms of dislocations, slip bands, and their density, microstructure, and fracture morphology.

Fernandez *et al.* (2002) studied the dynamic behavior of three different fiber fabric composite laminates by testing notched specimens in an instrumented Charpy machine. The registered impact force and displacement at the specimen hammer contact point were used to evaluate Mode-I fracture energy and dynamic fracture toughness. The changes in fracture toughness due to impact velocity, crack size and stacking sequence of the specimen were investigated with different degrees of aging conditions. Aging was found to significantly affect the dynamic fracture toughness, but had less effect on the static fracture toughness.

Bimal and Surendra (2002) wvaluated that Charpy V-notch impact toughness of 600 MPa yield stress TMT rebars alloyed with copper, phosphorus, chromium and molybdenum. Subsize Charpy specimens were machined from the rebar keeping the tempered martensite rim intact. The copper-phosphorus rebars showed toughness of 35 J at room temperature. The toughness of copper-molybdenum and copper-chromium rebars was 52 J. The lower toughness of phosphorus steel was attributed to solid solution strengthening and segregation of phosphorus to grain boundaries. Due to superior corrosion resistance, copper–phosphorus TMT rebar was a candidate material in the construction sector.

Mustafa (2008) investigated the impact-fatigue properties of unidirectional carbon fibre reinforced polyetherimide (PEI) composites. Low velocity repeated impacts wereperformed by using pendulum type instrumented impact tester (Ceast, Resil 25) at energylevels ranging 0.54-0.94 J. Samples were prepared according to ISO 180 and subjected to repeat low velocity impacts up to fracture by the hammer. Results of repeated impact study were reported in terms of peak load (Fmax), absorbed energy (Emax) and number of repeated impacts. An analytical model to describe the life time of composite materials subjected to repeated impact loadings was presented.

Ajit (2008) investigated the impact resistance of silicon (Si)-containing modified 9Cr-1Mo steels within a temperature regime of -40 to 44 °C using the Charpy method. The results indicated that the energies absorbed in fracturing the tested specimens were substantially lower at temperatures of -40, 25, and 75C compared to those at elevated temperatures. Lower impact energies and higher Ductile-to-Brittle Transition Temperatures (DBTTs) were observed with the steels containing 1.5 and 1.9 wt.% Si. The steels containing higher Si levels exhibited both ductile and brittle failures at elevated temperatures. However, at lower temperatures, brittle failures characterized by cleavage and inter granular cracking were observed for all four tested materials.

CAD MODEL OF HAMMER OF EXISTING IMPCAT MACHINE

Figure 2: CAD Model of Existing Impact Machine

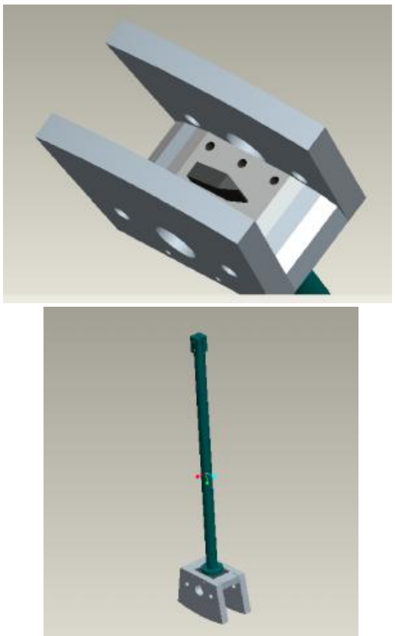
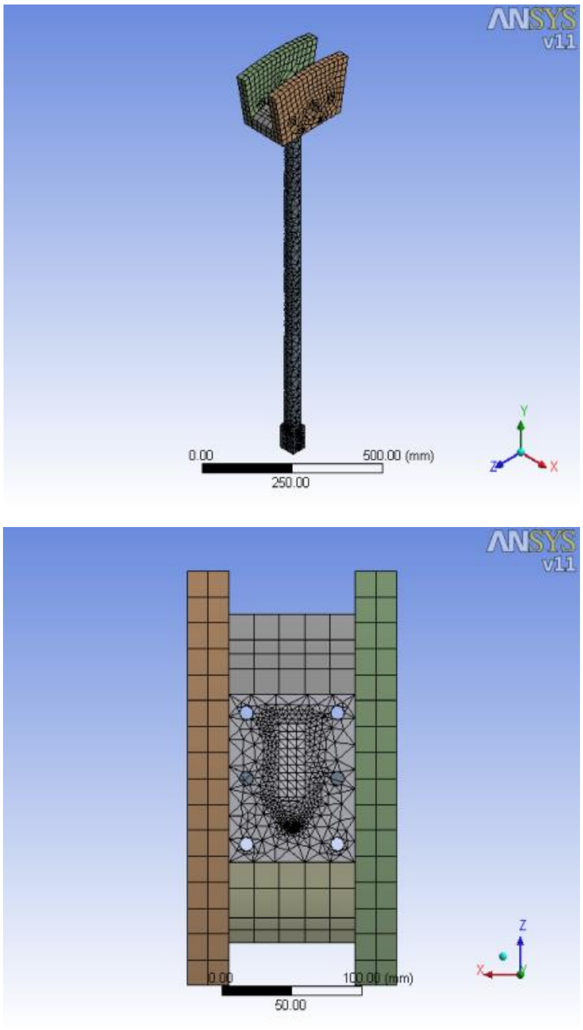


Figure 3: Finite Element Meshed Body of Hammer of Impact Machine



CONCLUSION

We have planned to perform impact test using different materials, at different temperatures by changing angle of impact for example at 450, 600, 750.

FEM analysis is also planned for the hammer of impact machine and also trying to find out the failures in the hammer. If possible, by changing design of hammer of impact testing machine, weight and cost can be reduced.

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