Energy Absorbed by Fall Protection Lanyards

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For many years, energy absorbing lanyards (EALs) have been used as a lifeline for industrial workers. When a worker falls from a height, an EAL's reduces the impact force experienced by the worker's body by dissipating a portion of the kinetic energy created during the fall. Consequently, most of the energy is absorbed by the lanyard instead of the worker. Although this is a very significant field of inquiry there has been very little research conducted on the instantaneous forces exerted on a falling worker. Currently, OSHA regulates *only* the maximum arrest force. However, it is important to understand all forces occurring throughout the fall in order to better evaluate the effectiveness of the EALs. The goal of this project is to develop a comprehensive method of testing fall protection lanyards that allows for the collection of instantaneous force and displacement data in order to obtain the power and energy dissipated during the fall. This information could later be used to improve on the designs of current fall protection equipment.

Interactive Molecular Dynamics Using LAMMPS and VMD

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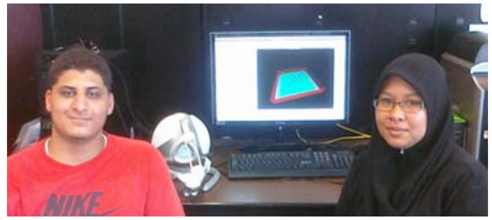

The aim of this research project is to install software that models molecules and allows users to interact with the molecules using the falcon. The falcon is a USB haptic device that enables users to interact with atoms and molecules in three dimensions with a force feedback. After installing the software, two specific molecular systems were programmed and run. The first molecular system that was programmed was a two atom system where one atom is stationary and the other can be moved. This was done to demonstrate the Lennard-Jones potential. The second molecular system is a simulation that allows users to manipulate Carbon Nanotubes to make it either slide or roll across a sheet of Graphene depending on its orientation.

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AERIM: Automotive and Energy Research and Industrial Mentorship Research Experience for Undergraduates (REU) Program at Oakland University

Student Research Poster Session

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This REU program provides hands-on, paid 10-week summer research experiences to talented and motivated undergraduate engineering students from across the United States. Student participants work in teams on automotive and energy-related research projects in mechanical engineering and also take part in other activities such as industrial research lab and facilities tours, meetings with working engineers, conferences and seminars. A total of 50 students from 39 different universities have taken part in the program since its inception in 2006. http://me-reu.secs.oakland.edu

Scuffing Behavior of 4140 Alloy Steels and Ductile Irons

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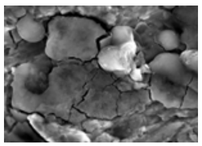

Scuffing is one of the main failure mechanisms for various engineering components, such as engine cylinder kits, gears and cam/followers. 4140 Alloy steel is used in the automobile industry because of its toughness, and ductile iron is known for the ability to make parts inexpensively. In this research, the scuffing behavior of 4140 alloy steel and ductile iron was investigated and compared through ball-on-disk scuffing tests. A step load of 22.2 Newtons every two minutes was applied with a light mineral oil as lubricant to determine the scuffing load. Both materials were heat treated to various hardness and the tests were conducted to compare the scuffing behavior of the materials when the tempered hardness of each material the same. Ductile iron was found to have a consistently high scuffing resistance before tempering and at tempering temperatures lower than 427^{o}C (HRC >45). After 427^{o}C the scuffing resistance decreases. 4140 Steel was found to have very low scuffing resistance at low tempering temperatures, but as the tempering temperature increased, the scuffing resistance increased. Ductile iron and 4140 steel had the same scuffing resistance at a tempering temperature of about 538^{o}C (ductile iron HRC 35-36; 4140 steel RC 40). The scuffed specimens were studied using optical and scanning electron microscopy to determine the scuffing mechanisms and scuffing results were analyzed based on material microstructure and hardness.

Heat Transfer Coefficient of Impinging Oil Jets on Pistons from Internal Combustion Engines

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A trend in the automotive industry toward increasing the power density of engines leads to higher engine component temperatures, which can exceed the design limits of the material. Limiting the engine performance can reduce temperatures in the combustion chamber and on the piston, but several manufacturers are using impinging oil jets on the piston undercrown to cool the pistons, instead. Because the oil jets increase the parasitic pumping losses of the engine, a study to determine their effectiveness has been proposed. The objective of this experiment is to develop heat transfer correlations between the oil jet and the undercrown of the piston. A piston was heated with a disk heater, outside of the engine, under steady-state heating conditions. Temperatures are recorded with thermocouples placed on the piston crown and undercrown. A temperature-controlled oil jet is sprayed onto the undercrown. Oil and piston temperatures as well as heater power are used to determine heat transfer coefficients for varying oil jet velocities. Calibration experiments have been conducted, and preliminary results have been found.

Tribological Properties of Nanofluids with Nano-diamond Particles

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Friction accounts for a large amount of energy lost in all mechanical systems and applications. Nanofluids, with particles less than 100 nm added to a base fluid, have been proven to be effective in reducing friction and wear. Diamond has superior mechanical, thermal, optical, electrical, and chemical properties. Therefore, nano-diamond holds a lot of promise to be used in nanofluids. The tribological properties of oil-based nanofluids with spherical nano-diamond particles size 3-10 nm in diameter were investigated using a ball-on-disk friction test by varying nano-diamond concentration, sliding velocity, normal load, and disk roughness. The friction testing was performed using a UMT-2 Micro Tribometer. Wear analysis and chemical composition of disk surface were carried out using a WYKO 3D Surface Profiler and X-ray Photelectron Spectroscopy (XPS). In general, the addition of nano-diamonds to oil leads to a reduction in the coefficient of friction while also increasing wear on the disk.