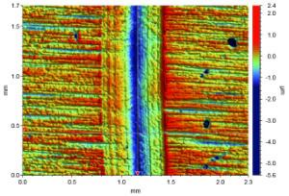
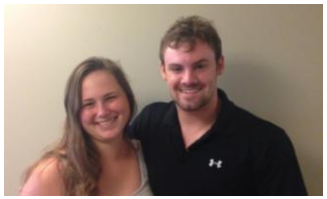
was measured using a Bruker Contour GT-K Optical Profiler and the wear volume was calculated. The effects of concentration and load on the coefficient of friction and wear will be reported. Stability of the solution was an important factor in deciding which mixture was best as this has been a problem in past studies. Therefore, in this research the effects of ultrasonic mixing time and concentration on the stability of the solution were also studied.

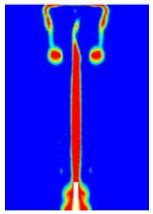


Numerical Simulation of Upward Jet Impinging on a Flat Plate

Sean Cassady - University of Virginia
Kathleen Dupre –University of Rochester
Advisors: Dr. Laila Guessous and Dr. Brian Sangeorzan; Yen Chung (Gary) Liu (Ph.D. Student)



Recent automotive advancements have increased the power density of commercial internal combustion engines and have heightened the need for efficient cooling mechanisms. One promising method, known as oil-jet cooling, uses a pump to direct a jet of oil onto the underside of the piston. Oil-jets have long been used in heavy duty and high performance engines, but their use in passenger vehicles is growing. The power required to pump the oil-jet is considered a parasitic engine loss, thus designers must work to maximize convective heat transfer while minimizing pumping power. The effectiveness of oil-jet cooling depends on several parameters such as the jet velocity, oil temperature, nozzle-to-piston distance, and specific fluid properties. There has been very little research published on the flow characteristics of upward-facing jets, and what has been published is largely focused on specific applications rather than generalized correlations. Without a fundamental understanding of oil-jet flows, determining the optimal conditions for cooling falls to guesswork. The current study aims to conduct a computational fluid dynamics study of the flow upward-facing jets. Using a structured 3D mesh within ANSYS Fluent, a jet impinging onto a flat plate is modeled as a transient, two-phase flow. The results of simulations that examine the effects of nozzle velocity and temperature on the jet flow profiles and impingement area will be reported. Such results are expected to contribute to the development of heat transfer correlations for oil-jet cooling applications.



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Contact:

Prof. Laila Guessous
AERIM REU Program Director
Department of Mechanical Engineering
Oakland University
Rochester, MI 48309
248-370-2183
Guessous@oakland.edu

Website: http://me-reu.secs.oakland.edu

OAKLAND UNIVERSITY

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

Student Research Poster Session

July 21, 2015

The AERIM REU program in the department of Mechanical Engineering at Oakland University is supported in 2014-2016 by the National Science Foundation REU Site program through NSF award No. EEC-1359137 (PI: Dr. Laila Guessous, Co-PI: Dr. Qian Zou). Additional Funding has been provided by the School of Engineering and Computer Science at Oakland University.

This REU program provides hands-on, paid 10-week summer research experiences to undergraduate students from across the U.S. Student participants work in teams on automotive and energy-related research projects and also take part in other activities such as industrial tours, meetings with working engineers, conferences and seminars. A total of 82 students from 58 different universities have taken part in the program since its inception in 2006.

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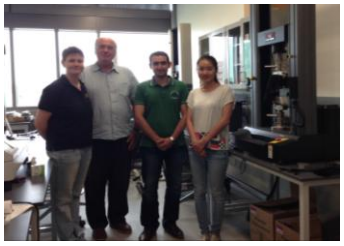
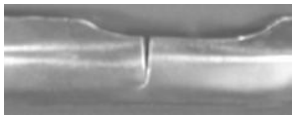
Trimming of Sheet Blanks from Ultra High Strength Steel Sheet

Kaicen Pan – Stony Brook University, New York
Lindsay Brown - Arizona State University
Advisors: Dr. Sergey Golovashchenko and Saeid Nasheralahkami (Ph.D. student)



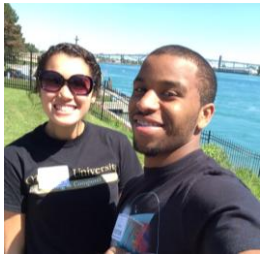
Lightweight sheet materials such as Ultra High Strength Steels (UHSS) are gradually replacing mild steels to reduce vehicle's weight and improve fuel economy. Implementation of UHSS is often problematic due to the splitting of parts from the sheared edge when stretched. In order to understand the limitations of sheared edge stretchability and account for them during die design process, an experimental study on trimming and tensile testing along the sheared edge is being performed for two kinds of UHSS, DP980 Alloy 1 and Alloy 2. The effects of cutting clearance and tool wear on quality of sheared edge and its stretchability were studied during this experiment. A 65 ton mechanical press with an experimental trimming die was used; height of burrs and burnish zones were measured for six cutting clearances for new cutting inserts and also for cutting inserts which performed 35,000 cuts of 1.5mm DP980 sheets. Conducted measurements indicated that below specific cutting clearances, almost no burrs were observed in the three trimming directions. It is also shown that Stretchability of sheared edge after trimming has a tendency to decrease as the clearance between the trimming die edges increase.



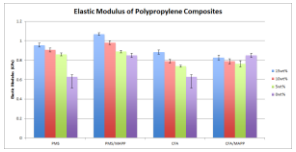
An Incorporation of Waste Stream Materials into Plastic Composites

Emily Bautista – Virginia Tech
Michael Greene – University of Pittsburgh
Advisor: Dr. J. David Schall

With the increasing demand of fossil fuels, the automotive industry is continually searching for methods to improve vehicle fuel economy. One approach lies in the reduction of vehicle weight by implementing cutting-edge composite



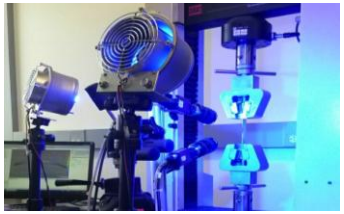
materials in the interior components of vehicles. The incorporation of wood-based or coal based waste stream materials as additives in plastic composites has shown to significantly decrease the plastic component weight without detrimentally affecting the mechanical properties of the plastics. Moreover, these materials further the global initiative to increase sustainability. This research investigates the alteration of the mechanical behavior of polypropylene that has been enhanced with long glass fibers and paper mill waste, a cellulose based material, or coal fly ash, a silica based substance. Maleic anhydride polypropylene, a binding agent, is added in order to enhance the adhesion of the component materials. The concentration of paper mill sludge or coal fly ash and long glass fibers within the polypropylene composite samples range from 5-15% and 20-40% by weight, respectively, as these percentages have proven to be the most effective.Tensile and impact tests will be performed on each sample to determine the extension capabilities, tensile stress and strain, and elastic modulus of the material. These tests are expected to reveal the optimal combination of paper mill waste or coal fly ash and glass fiber within the composite so that the resulting material has the highest possible tensile and impact strength. This material would not only reduce vehicle weight but also overall vehicle cost while simultaneously following an environmental agenda.



The Influence of Edge Quality on Edge Stretching Limit for Aluminum Alloy

Haley Linkous – Oakland University
Eduardo Bustillos - Youngstown State University
Advisor: Dr. Lianxiang Yang and Xin Xie (Ph.D. student)

This poster presents analysis of the edge stretching limit of aluminum alloy using digital image correlation. The edge stretching limit, is the maximum thinning strain at a point of edge failure resulting from tension; which may be predisposed by edge quality. Edge fracture is a vital failure mode in sheet metal forming, however it is very difficult to measure. A previous study enabled the measurement of edge thinning strain by using advanced digital image correlation but it did not consider how the edge quality could affect the edge stretching limit of aluminum alloy. This paper measures edge thinning strain by comparing polished to unpolished AA5754, thus determining the effect edge quality has on the edge stretching limit. To enable the measurement by optical methods for a very long and thin sample, a notch is used to localize where edge failure occurs. The notched edges of the various pre-strained aluminum alloy samples are polished to eliminate surface micro cracks from punch machining. A 3-D digital image correlation system is used to measure strain during tensile testing in the thinning direction. The test results indicate that surface micro cracks do not have significant influence on the edge stretching limit of aluminum alloys.



Investigation of the Stability and Tribological Properties of Ionic Nanofluids

Olivia McIntee – Oakland University
Daniel Pena – Florida International University
Advisors: Dr. Qian (Beth) Zou and Dr. Luan Gara (University of Prishtina)

In this research, the tribological performance of ionic nano liquids was investigated. In previous studies nanoparticles and ionic liquids have been used separately as oil additives and have been shown to reduce friction and wear. Now the results of combining nanoparticles and miscible ionic liquids together as oil additives will be reported. Zinc oxide nanoparticles were dispersed using a ultrasonic homogenizer in a mixture of Polyalphaolefin oil and ionic liquid (Tetradecyltrihexylphosphonium bis(2,4,4-trimethylpentyl)phosphinate) using an ultrasonic homogenizer. The coefficient of friction was studied using a tribometer with a ball-on-disk configuration. The wear track