Summer Internship Report

Energy Engineering Research Consortium EERC • August 4, 2009

EERC Summer Internship Program

In this program, PI students visit UMD for seven weeks over the summer to work with a UMD professor and graduate students on a current EERC or other UMD research project.

The EERC is dedicated not only to conducting cutting-edge research in fields of importance to the oil and gas industries in the UAE, but also to establishing best educational practices at the PI. The **EERC Summer Internship Program** is an important part of the educational arm of the EERC, providing PI students with the opportunity to study with UMD professors who are world leaders in their fields, to interact with graduate students from UMD's culturally diverse Clark School of Engineering, and to experience life in the United States, if only for a short time.

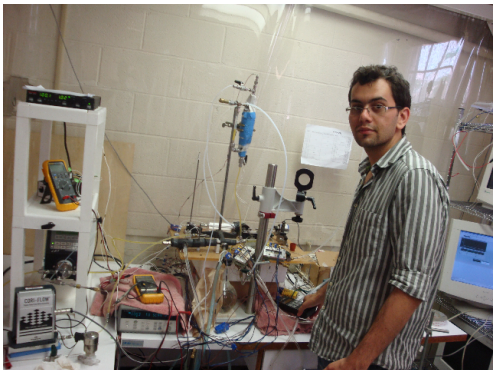
This year, eleven PI students were selected to participate in the program. In between sessions in the lab, they took trips to Baltimore's Wheelabrator waste-to-energy facility to see a clean-energy plant in action and to Boston, to visit the world-renowned MIT. They also took in the sights of nearby Washington D.C. and visited the nuclear reactor lab at UMD.

The aims of the program are to provide students with valuable research and engineering skills through working on actual EERC and other UMD research projects, to give them experience collaborating with students and professionals from diverse backgrounds, to encourage them to pursue graduate education, and to expose them to a variety of cultural experiences through travel abroad. As the student projects on the next page show, the second year of this program was highly successful, and we anticipate many more years of this fruitful exchange of students and ideas.

Student Projects

Each student worked with a UMD professor and graduate student supervisors on actual ongoing research projects. They gained practical, hands-on experience and valuable engineering skills in addition to experience working with students and professors from culturally diverse backgrounds.

Alaa Khalil



Alaa Khalil, a mechanical engineering major, worked with Dr. Serguei Dessiatoun and student supervisors Ratnesh Tiwari, Ebrahim Al Hajri, and Mohammad Al Shihhi, on **"Microreactors for Oil and Gas Separation Processes using Microchannel Technologies."** Their objectives were to explore the possibilities for developing a novel microreactor based on microchannel technology, which included conducting a literature review on microreactors, assisting with the design of a laboratory-scale microreactor using microchannel technologies, giving an oral presentation to faculty and graduate students of research results, and presenting a report on their findings and recommendations. Alaa reports, "The lab staff did a great job in supporting me in my project and I am seriously considering graduate studies after this exceptional experience. I will try to work on microreactors for my senior design project."

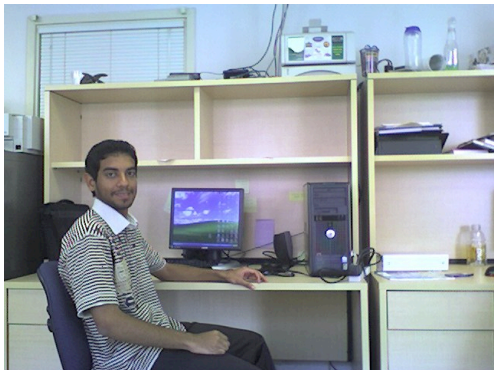
Bilal Sarris

Bilal Bassam Sarris, also a mechanical engineering major, worked on **"Waste Heat Utilization in Oil and Gas Industries"** with Dr. Reinhard Radermacher and student supervisor Amir Mortazavi. He helped model simple and sophisticated cycles in ASPEN Plus and ASPEN HYSYS; he learned how to model various components in ASPEN HYSYS; and he modeled the entire gas production process in HYSYS, so that the system can now be optimized by UMD as required by PI.

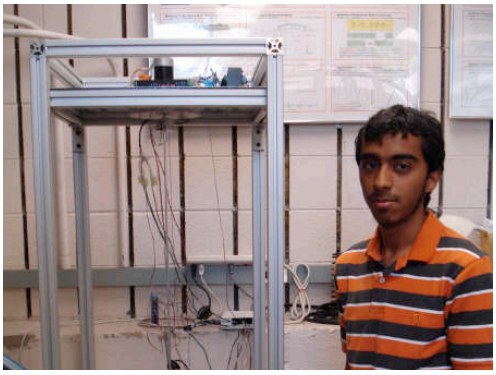
Nabil Hirzallah

Nabil Hirzallah is an electrical engineering major who worked with Dr. Shihab Shamma and student Ling Ma on **"Segregation of Speech using the Cortical Model."** The objectives of the study were to learn how the brain intercepts sound and speech (auditory scene analysis) and to apply the results from the cortical model in the segregation of two speeches. Nabil learned the algorithm and ways to approach the problem, along with the cortical model Matlab toolbox.

Waled Saeed and Alawi Abdulla



Waled Saeed



Alawi Abdulla

Waled Saeed and Alawi Abdulla worked with Dr. Bala Balachandran's group on **"Dynamics and Control of Drill Strings."** Working with graduate students Nick Vlajic and Chien-Min in the Vibrations Lab, Waled and Alawi learned the concepts, process, and structure of research. They also learned the fundamental usage of accelerometers, signal processing by Matlab, the data acquisition software Labview, as well as the use of general-purpose lab equipment and techniques such as an oscilloscope, a signal generator, a digital multimeter and soldiering techniques. They also helped perform a series of experiments on the lab's drill-string model. Waled assisted in a major portion of this experiment and helped design the camera mount for taking images from the experiment. To do this, he created a 3D model with corresponding drawings on Solidworks. Alawi worked with a manufacture's Labview code used in camera control.

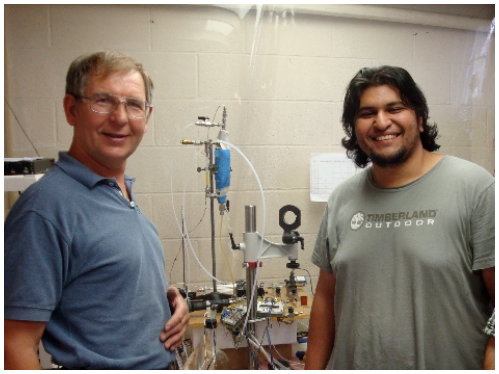
Ahmed Khalil

Ahmed Khalil, a mechanical engineering major, worked on **"Thermally Enhanced Polymer Heat Exchangers"** with Dr. Avram Bar-Cohen and Dr. S.K. Gupta. The objectives of the study were to identify and understand the model used by Moldflow for fiber orientation predictions, to study the effects of different molding conditions and different geometries on the fiber orientation, and to verify experimentally the fiber orientation predictions. Ahmed performed a literature survey on the Folgar-Tucker model, helped perform and analyze Moldflow simulations, and helped fabricate samples for experiments and perform the experiments.

Saleh Al Hilali

Working with Dr. Reinhard Radermacher and Ali Al-Alili, Saleh Al Hilali studied **"Solar Powered Cooling Systems for Houses in Abu Dhabi."** The objectives of the study were to study the performance of different PV technologies under Abu Dhabi's weather conditions using TRNSYS and to gain an understanding of engineering design steps. Saleh learned that problem modeling is one of the engineering design steps: "I learned how to use TRNSYS and I modeled the solar system and the conditioned area." He also compared PV (photovoltaic) panel technology (crystalline vs. thin film) using TRNSYS and found that almost each category behaves almost the same. He conducted a parametric study using TRNSYS by varying the Tambint of the PV panel and found that if the PV panel temperature increases, the output power will decrease. Finally, he coupled the PV panel with the VCC and the conditioned space.

Abdallah Helal

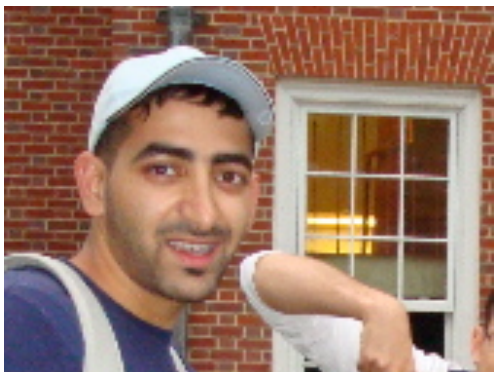


Abdallah Helal worked with Dr. Serguei Dessiatoun on a CO_2 separation project, **"Study on Microchannel-Based Absorber/ Stripper and Electrostatic Precipitators for CO_2 Separation from Flue Gas,"** which is based on the chemical absorption and desorption of CO_2 using monomethylamine. His work focused on the desorption part of the process. During his internship he performed a literature review of desorption and participated in designing an experiment in which the absorption and desorption processes could be studied and visualized. In this experiment the team used LiBr-water absorption and desorption to study the process. Abdallah helped design and fabricate the microchannel desorber and participated in putting together the experimental setup and instrumentation and making it operational. He also collected preliminary data and gave two presentations on his work.

Mohammed Abudaga

Mohammed Abudaga, a mechanical engineering major, worked with Dr. Mohammad Modarres and Mohamed Chooka on **"Risk Analysis and Probabilistic Study on Corrosion on X-70 Steel."** The objectives of their project were to predict the behavior of corrosion on X-70 steel samples using NaCl. They performed three experiments, each for a different length of time (five, ten, and twenty-four hrs). Five samples were placed in different concentrations of an NaCl solutions in each experiment. All together, fifteen samples were used to predict the behavior of corrosion on static X-70 steel in an NaCl environment. The results of the experiments complemented those found in a literature review of similar investigations.

Abdullah Tamimi



Studying with Dr. Mohammad Modarres, Abdullah Tamimi worked on **"Development of a Probabilistic Model for Degradation Effects of Corrosion-Fatigue Cracking in Oil and Gas Pipelines."** The purpose of this experiment was to understand the fundamentals of pitting corrosion and its effect on certain alloys and metals. Several tests were performed to gather information about the failure of specific specimens used in the manufacturing of oil and gas pipelines, with the objective being to apply reliability engineering concepts to predict any possible failures in these pipelines in the future. The experiment focused mainly on measuring the pit depth, pit density and mass loss after exposing the samples to different corroding environments with different concentrations and for different time periods. Furthermore, statistical methods were used to find the distribution of the pits over the specimen surface, and reach to a better understanding about the behavior of the corroding environment on these distributions. The group's results matched the theoretical background in the literature, especially the Hoeppner and Kondo models. It was found that the pit depth was affected strongly as the H_2S concentration increases and as the time increases.

Nalah Al Amoodi

Nalah is a graduate student in chemical engineering who worked with Dr. A.K. Gupta. Nahla writes, "For my summer training, I worked in the combustion laboratory [on] research that is concerned with sulfur recovery from hydrogen sulfide using [the] Claus process. I have been involved in both simulation and experimental aspects in order to investigate the efficiency of sulfur recovery from acid gas that contains different contaminants. This topic is very critical to the industry in my home country since the hydrogen sulfide composition in the natural gas wells is very high. Working in UMD [was] an unforgettable experience. I have [learned a lot] about the Claus process and the approach needed to conduct different investigations. Also my technical skills have been developed while working in the laboratory. I believe this is one of the most interesting summer internships I [have] had."

Student Suggestions

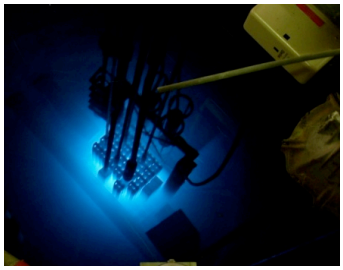
The main suggestions participants have for the program are to either extend its length or to focus the research tasks more narrowly. "The time constraints limited the application of different options and solutions for...the experiment." Alaa Khalil writes. Bilal Sarris agrees: "It would be much better if the internship period [were] at least 10 weeks."

In addition, Saleh Al Hilali observes that "the students who had the opportunity to work on the labs had more benefits than those who worked only in the office modeling systems. We can have the simulation programs in PI, but the labs aren't there."

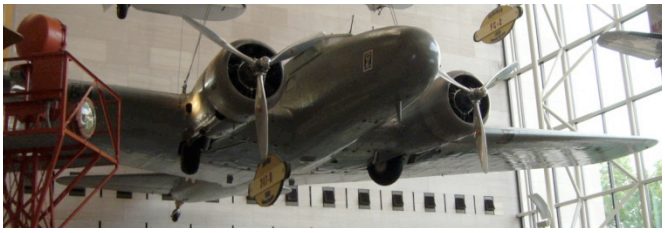
Visit to Waste-to-Energy Facility

Professor A.K. Gupta took the interns to visit the Wheelabrator Baltimore waste-to-energy facility, which provides dependable, environmentally safe disposal of municipal solid waste for the City and County of Baltimore, Maryland while generating clean electricity for sale to the local utility. The Baltimore facility, designed, constructed, owned and operated by Wheelabrator Technologies Inc., processes up to 2,250 tons per day of municipal solid waste. At full capacity, the plant can generate more than 60,000 kilowatts of electrical energy for sale to Baltimore Gas & Electric Company. This is the equivalent of supplying all of the electrical needs of 50,000 homes. Steam is also supplied by the plant to Trigen Baltimore Corporation for the downtown heating loop.

UMD Nuclear Reactor and Washington D.C.



Locally, students also visited the nuclear reactor on the UMD campus, one of the few reactors on a state university campus. The reactor is used for research by university scientists as well as NASA and other industry leaders. The students also enjoyed the Smithsonian National Air and Space Museum, where they explored milestones in American flight and aerospace.



Boston Trip

On June 25-28, the students visited Boston to visit world-renowned Harvard University and the Massachusetts Institute of Technology. Through a prearrangement with MIT, students visited the Fluids Laboratory in the Department of Mechanical Engineering. This was followed by a general tour of the institution. Another guided tour took the students through Harvard. Mr. Amarildo DaMata, from UMD, accompanied the students in this trip to ensure everything was organized and well managed.