

Mechanical Engineering Senior Design Projects

Abstracts of Presentations

19 October 2006

10:30 am

10:30 Set-Up and Introductions

10:35am SAE Aero Design

Faculty Advisor: Dr. Fred Ferguson

The aero design is an international competition sponsored by the Society of Automotive Engineers (SAE). The objective of the competition is to design, fabricate and test a gas powered radio controlled aircraft that can takeoff and land while carrying a maximum payload. The competition will be judged on the plane's ability to lift from the ground within a takeoff zone measuring 200 feet in length, complete one 360° circuit in a designated airspace and successfully land. The aircraft has to meet certain competition regulations for wing span limit, cargo bay area, and engine usage.

10:45 am Design of an SAE Mini Baja Off-Road Vehicle

Faculty Advisor: Prof. Daniel Acree

SAE Mini Baja is an intercollegiate design competition in which students from around the world design and fabricate Baja style off-road vehicles. The design teams and vehicles are judged based on their performance in a variety of static and dynamic events. The vehicle is to be designed to traverse a number of obstacles including hills, rocks, logs, mud, and deep water. The vehicle must also be safe, durable and fun to drive.

The team will be designing the components, producing CAD drawings, selecting and testing the materials, and performing finite element analysis. All structural fabrication and assembly processes will also be completed by the team. The vehicle will then be tested in preparation for three competitions, the first of these in April.

10:55 am Pulse Jet Mixing

Faculty Advisor: Dr. Gary Tatterson

The purpose of this project is to build a scaled down model of the Department of Energy's Jet Pulse Mixer. The student team will also construct a rectangular, Plexiglas casing for the primary tank to minimize optical distortion. The findings of this project will include analysis of flow regimes inside the system.

11:05 am The Pisgah Astronomical Research Institute (PARI) Radio Telescope Study

Faculty Advisor: Dr. W. J. Craft
Corporate Sponsor: PARI

PARI Component Descriptions

Balance the 26-Meter East Radio Telescope Dish

The East large aperture (26 meter) radio telescope, 26E has not been balanced in recent years. This balance is important to identify the degree of out-of-balance and to verify the calibration of the control system for the major and minor axes servo motors and instrumentation systems. Attaining a specific counterweight balance is important in assuring that the instrument safely reverts to the up position should there be power or brake failure.

Surface Analysis

The dish surface of both 26E and 26W must be very closely approximated by a paraboloid or parabola or revolution to maximize the energy collection of the system, particularly at high radio frequencies. We are had run some data already (last year) and this needs to be fit to a multi-parameter optimization model (probably a 6 degree of freedom fit) through a least square procedure so that the surface deviations can be checked.

Instrument Carrier, Communications, and Control

We will design an instrument carrier that mounts near the focus of either dish. This design will involve two separate component or sub-projects:

- a) **Instrument carrier** – The carrier will be composed of a 1, 2, and 3-axis motorized axis or axes to which an experiment is mounted. It will be able to move in 1, 2, or 3 planes to remotely control the location of the instrument.
- b) **Instrument communications software and control** – The instrument is to be controlled via an optical fiber cable which must receive remote signals to move the package along one of 3 axes. In addition, the package must be able to transmit its position to the remote site for verification.

11:15 pm ASME 2007 Design Challenge

Faculty Advisor: Dr. Juri Filatovs

. In times of disasters potable water is not available, and a small, easily transportable and assembled device, with all power coming from human effort, would be invaluable. A portable, human powered, purifying system for biological and chemical contaminants in water is to be designed and constructed. This design is challenging as rough estimates show the power available makes the process barely viable. A competition for the best design will be held 31 March 2007, and will be based on the smallest device producing the greatest purified volume.