AEROSPACE & MECHANICAL ENGINEERING

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UNIVERSITY OF NOTRE DAME, NOTRE DAME, INDIANA 46556

SPEAKER: **Dr. Barbara B. Botros**
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United Technologies Research Center
East Hartford, Connecticut

TOPIC: **LAND TO AIR: ENERGY EFFICIENCY IMPROVEMENTS IN POWER PLANTS AND JET ENGINES**

DATE: Tuesday, March 26, 2013

TIME: 3:30 p.m.

PLACE: Lower Level Auditorium, Geddes Hall

RECEPTION: 3:00 – 3:30 p.m. – Coffee House, Geddes Hall

ABSTRACT

Much of current energy research is focused on developing and improving new technologies based on a scientific understanding of the thermal-fluid phenomena within the system. In this talk, I will focus on applications in aircraft engines and heat recovery in coal gasification plants. The first area of research presented here analyzes the complex flow field in highly-loaded, high Mach number (HLHM) axial compressors used in aircraft engines. The primary challenge specific to this operating regime, compared to that for subsonic compressors, is the aerodynamic coupling between blade rows due to the presence of shockwaves. The shockwaves from the downstream rotor blade row create an unsteady upstream pressure field that generates the shedding of wake vortices from an upstream vane row. A computational methodology will be described to quantify local entropy generation in the simulations, even in regions with high spatial gradients (e.g. shock waves). Furthermore, a new non-dimensional parameter "B3"will be presented that characterizes the trajectory of these vortices and, in turn, the level of rotor loss.

The second area of research is aimed at improving heat recovery in coal gasification plants with carbon capture by using novel working fluids to efficiently harness the available heat for power production. One particular location that alternative heat transfer fluids can be used, other than conventional steam, is in the radiant heat exchanger following gasification. In a conventional radiant heat exchanger, heat is transferred inefficiently from hot syngas to boiling water across a large temperature difference. The temperature difference can be reduced by using fluids such as liquid metals or molten salt. A capital cost analysis shows the payback time of implementing this innovation is less than a year, making this a realistic option for gasification plants.

NOTE: *If you are interested in meeting individually with Dr. Botros, please contact Linda at 631-5431*