GRADUATE STUDENT RESEARCH SEMINAR SERIES (2017)

NUMERICAL MODELING OF FRICTION ELEMENT WELDING PROCESS

SPEAKER: ANKIT VARMA

To reduce the greenhouse gas (GHG) emissions resulting from vehicles across different categories, various governments through the world have set ambitious target of improving the fuel economy while retaining the performance characteristics of the vehicles. With stringent regulations to be complied with, the automotive manufacturers are shifting towards using a mix of lightweight materials like high strength alloys of aluminum and advanced high strength steels which offer superior strength to weight ratio compared to the currently used materials like mild steel. These modern lightweight materials cannot be efficiently joined with current welding methods such as resistance spot welding or arc welding prevalent in the automotive industry. To produce a defect-free weld between these dissimilar materials which are physically and metallurgically incompatible, different processes such as Flow Drill Screws (FDS), RIVTAC®, Friction Self-Piercing Rivets (FSPR), and Friction Element Welding (FEW) have been proposed. Of these processes, FEW is relatively new and has been gaining significant attention due to its unique benefit of welding materials of varying thicknesses and mechanical strengths in minimal time with low input energy. FEW process can be utilized for joining aluminum alloys of thickness up to 5 mm to high strength steels whose tensile strength can vary from 270 MPa to 1600 MPa. However, its physical mechanisms are not fully understood, and the relationship between process parameters and the joining quality has not been established. The goal of this project is to bridge this gap by developing a finite element model of FEW process and predicting the evolution of temperature, stress, material flow, phase change, and welding quality. The finite element model will be validated against the experimental measurements and utilized to gain an understanding of the fundamental mechanisms occurring during the process, which would eventually aid in optimizing the FEW process.

MONDAY, OCTOBER 2 AT 3:00-4:00 PM

EIB 132