

# DEPARTMENT OF MECHANICAL ENGINEERING

## WILLIAM MAXWELL REED SEMINAR SERIES

### “Ductile fracture modeling of aluminum alloy under proportional loading”

Dr. Madhav Baral

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**Abstract:** It is well known that metals experience ductile fracture and the loss of load-carrying capacity when plastic deformation reaches a certain limit. Therefore, the accurate characterization and prediction of ductile fracture in materials has real-world importance in the design and optimization of processes and products. More importantly, the prediction of ductile fracture is critical in light-weighting and crash studies in automotive industry. The ductile fracture of aluminum alloy (sheet and tubular material) is investigated with the hybrid experimental-numerical method. First, the plastic anisotropy is assessed using a combination of experiments that are used to model the plastic behavior using advanced non-quadratic yield criteria and a hardening model. Then, the fracture behavior is investigated using conventional and novel specimen designs at different stress states that remain proportional throughout the loading history. Fracture oftentimes initiate at the interior of the specimens and thus direct measurement of fracture parameters is not possible from experiments alone. Instead, these parameters are obtained using finite element (FE) modeling with the material modeling framework using anisotropic yield criteria. The results from the FE models are used to calibrate both classical and recent fracture initiation models, along with a newly proposed model that is shown to offer better flexibility in capturing the measured fracture locus.

**Bio:** Dr. Baral is a Postdoctoral researcher at the John Olson Advanced Manufacturing Center at University of New Hampshire. He received his Ph.D. in Mechanical Engineering at University of New Hampshire in Sep. 2020. His research interests include solid mechanics, ductile fracture, plasticity, constitutive modeling, finite element modeling, formability, advanced manufacturing, and acoustic emissions. involving autonomous air and ground vehicles.

**Date:** Feb 25, Thursday

**Time:** 3-4 pm (CST); 4-5pm (EST)

**Place:** <https://uky.zoom.us/j/83008957257?pwd=MmVWwW9MODBJaW1HZXpPaEkzSko2Zz09>

Attendance open to all interested persons



Paducah Engineering Seminar Series

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