AEROSPACE & MECHANICAL ENGINEERING

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INFORMAL COFFEE PERIOD BEFORE THE SEMINAR IN ROOM 365 FITZPATRICK HALL

UNIVERSITY OF NOTRE DAME, NOTRE DAME, INDIANA 46556

EDISON LECTURE SERIES

SPEAKER: **Robert H. Dodds Jr.**
M.T. Geoffrey Yeh Endowed Chair of Civil Engineering
University of Illinois at Urbana-Champaign
Urbana, Illinois

TOPIC: **3D MODELS OF STEADY CRACK ADVANCE IN DUCTILE METALS**

DATE: Tuesday, February 15, 2011

TIME: 3:30 p.m.

PLACE: 138 DeBartolo Hall

ABSTRACT

During sustained ductile tearing, high-performance structural metals (*e.g.,* Al, Ti alloys) in thin panel applications generally have in-plane plastic zone sizes quite small relative to the panel dimensions but comparable to the thickness, *B*. Near the crack front, and over a region of no more than a few multiples of *B*, the strain-stress fields reveal strongly 3D features. At larger distances from the advancing crack front, the fields become linear-elastic and plane-stress.

At steady conditions, the crack front loading remains fixed, and the near-front fields appear invariant with respect to an observer situated on the crack front and moving with it at a constant velocity. For small deformations, the temporal rate of change for any field quantity equals the spatial rate of change parallel to the direction of crack growth for that same quantity. This relationship leads to an efficient numerical framework to compute the elastic-plastic, near-front fields for steady-state crack growth.

In these first published analyses for 3D steady growth, the crack front remains well contained within a linear-elastic, plane-stress region where the mechanical fields are described by the remote K_I and the non-singular *T*-stress. A 3D "boundary layer" setting supports exploration of the crack front fields. The thickness (*B*) provides the only, natural geometric length-scale, and it links the in-plane loading levels with 3D effects near the crack front.

The presentation summarizes concepts of the 3D steady-state formulation and key features of the first solutions obtained using the model with particular reference to the non-dimensional loading parameters.

NOTE: *If you are interested in meeting individually with Prof. Dodds, please contact Evelyn at 631-5431.*