

DEPARTMENT OF MECHANICAL ENGINEERING

WILLIAM MAXWELL REED SEMINAR SERIES

Modern Ablation Modeling

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Abstract: Ablation is a mass removal process due to heat. Its application on thermal protection systems (TPS) for spacecraft is focused in this talk. During a planetary entry, the traveling vehicle enters at a hypersonic speed, from which a large amount of heat is generated and applied to the front surface of the vehicle. The TPS of this kind of vehicles is therefore specially designed to mitigate the excessive heat, with the use of ablative materials. Accurate prediction of the material response, i.e. the mass loss and the heat transfer, is crucial to the success of the mission. However, this is not easy for two reasons: the material properties under planetary entry condition are not easy to obtain, and the material response is closely coupled with the surrounding gas flow. Therefore, modern ablation modeling focuses on improving the fidelity of material models and enforcing a stronger coupling. The current state-of-the-art approach is to use two separate computational solvers: a fluid solver and a material solver. The interface of the two is very difficult to model, on which simplified assumptions are usually made. As an alternative approach, a novel framework is proposed and developed, with which the free flow and the material response are solved seamlessly with one set of equations and on one mesh. It has the advantages of automatically ensuring interface conservation, as well as removing the complexity of moving mesh algorithms; both of which are quite challenging with the conventional approach in modern ablation modeling.

Bio: Haoyue Weng is a Postdoctoral Scholar in the Department of Mechanical Engineering at University of Kentucky. Born and raised in Beijing, Haoyue went to Beijing University of Posts and Telecommunications for college, from which he received his Bachelor degree in Electrical Engineering in 2009. Since then, he moved to Lexington to pursue his doctoral degree at University of Kentucky. Haoyue worked with Dr. Patrick G. Hu initially but then switched to Dr. Alexandre Martin in fall 2011, with whom Haoyue focused on modeling ablative materials, and received his Ph. D. in December 2014. Afterwards, he chose to continue his research with Prof. Martin as a Postdoc, and extended his research interest to transport models for porous media.

Date: November 3, 2017
Place: CB 118

Time: 3:00 to 4:00p
Contact: Dr. Alexandre Martin 257-4462

Meet the speaker and have refreshments
Attendance open to all interested persons



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