



SCHOOL OF  
**MATERIALS SCIENCE  
AND ENGINEERING**  
College of Engineering, Architecture and Technology

## CHARACTERIZING THE MECHANICAL PROPERTIES OF SHALE

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Wednesday, November 4, 2020 | 11am - 12pm | Platform - Zoom Meeting

#### Abstract

A novel experimental technique is used to determine the orthotropic and bi-modulus properties of dry Oklahoma shale. Circular specimens are loaded in diametral compression using the Brazilian disk configuration and full-field strains are monitored using digital image correlation. An over-deterministic least-squares approach is used to analyze the experimentally determined strains in conjunction with analytical expressions of the strain fields under elastic loading conditions. Tests are conducted using specimens loaded in two directions, namely, parallel and perpendicular to the bedding planes. The analysis of these two tests yield the elastic moduli along the two principal material axes under both tension and compression. In addition, the analysis at the point of failure is used to determine the tensile failure strengths along the two principal material directions. The technique is used to determine the properties of three different Woodford shale materials from the Anadarko and the Anarko basins. It is found that considerable variations in elastic anisotropy and strength anisotropy are possible depending on the shale source. This has important implication on the use of shale properties to predict hydraulic fracturing parameters that will lead to optimum yield.

#### Speaker



Dr. Raman P. Singh is a professor in the School of Mechanical and Aerospace Engineering and a professor in the School of Materials Science and Engineering, at Oklahoma State University (OSU). He holds the Helmerich Family Endowed Chair Professor of Engineering. He serves as the Associate Dean for Engineering at OSU-Tulsa, the Head of the School of Materials Science and Engineering, and the Director of the Helmerich Advanced Technology Research Center on the OSU-Tulsa campus.

Dr. Singh holds MS and PhD degrees in Mechanical Engineering and Applied Mechanics, both from the University of Rhode Island, and a B.Tech. degree in Mechanical Engineering from the Indian Institute of Technology, Kanpur, India. Prior to joining OSU in 2006 he was a faculty member at the State University of New York at Stony Brook, and before that a post-doctoral scholar at the California Institute of Technology. Dr. Singh's research interests are in the mechanics of advanced materials, with an emphasis on experimental solid mechanics, failure mechanics, and composite materials. His academic interests are in student mentorship, development, and retention with a focus on new pedagogical methods. His research has been funded by the National Science Foundation, NASA, the Oklahoma Center for the Advancement of Science & Technology, the Oklahoma Transportation Commission, the Department of Defense, the Department of Energy, the Office of Naval Research, and industry. He has authored or co-authored over fifty archival journal publications and several conference proceedings. He holds two patents. Dr. Singh is an active member of the Society of Experimental Mechanics (SEM) and has served on the executive board. In addition, he is currently an associate technical editor for Experimental Mechanics. He is also a member of the American Society of Mechanical Engineers. Besides academia, he enjoys travel, backpacking, and photography.

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