

# Failure of Hemp Fiber Reinforced Composite Laminates

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## Abstract

Here, we conduct micro (Figure 1) and macro (Figure 2) stiffness, and failure analyses of hemp fiber reinforced composite laminates. Stacking sequence with 0, (0/90)<sub>s</sub> and (0/90/±45)<sub>s</sub> laminates are selected. Based upon micromechanical models of predicting effective properties of composite ply and laminates, we have used N Directional Stiffness AND Strength (NDSANDS) module and Composite Laminate Analysis Program (CLAP) module of the Automated System for Composite Analysis (ASCA) [Soni 1994]. Effective properties of at least 3 cases of hemp fiber reinforced composite laminates are calculated using constituent properties [Bhoopati and Suresh 2019]. A set of hemp reinforced composite laminates, will be considered for conducting relevant stiffness and failure analysis by using quadratic polynomial failure theory [Tsai-Wu, 1985].

## Keywords

Hemp, fiber, Composites, Laminates, Micromechanics, and Macromechanics

## Biographies

**Dr. Som R. Soni** has PhD from University of Roorkee (renamed as IIT Roorkee) India, 1972. Dr. Soni has more than 40 years of experience in teaching and research related to systems engineering design, analytical and experimental mechanics of composite materials and structures. Dr. Soni retired from AFIT in December 2011. Before joining as an Associate Professor in the Air Force Institute of Technology in December 2005, Dr. Soni was involved in AdTech Systems Research Inc as President and CEO for more than 20 years (1984- 2005). Dr. Soni's recent studies include: a) Cost modeling of composite Aircrafts; b) Systems Engineering Approach to Integrated Health Monitoring System for Aging Aircrafts; and c) Ballistic response of co-cured adhesive bonded composite joints. Dr. Soni is author/ co-author of 100+ research publications in the field of mechanics of solids and structures with special emphasis on composites. Dr. Soni is a Fellow of the American Society for Composites and A Google Scholar. He has won numerous awards including Co-author of Air Force Materials Laboratory's Cleary Award publication, State of Ohio Edison Emerging Technology Award, Enterprise Spirit Award of Kettering Moraine and Oakwood Chamber of Commerce; and Engineering Science Foundation (Affiliate Society Council) Award for Outstanding Professional Achievement for his accomplishments. Co-author of First place winner of IEOM international Conference, Lisbon, Portugal in Modeling and simulation competition 2023. Co-author of First place winner of IEOM international

Conference, Sydney, Australia in Modeling and simulation competition 2024. Dr. Soni is a Heartfulness meditation trainer for more than 30 years.

**Dr. Schluttenhofer** has PhD from the Department of Plant & Soil Sciences, University of Kentucky, Lexington, KY; 2016. Dr. Schluttenhofer is a Research Associate Professor of Natural Products at Central State University, Ohio. He is leading research and development efforts in hemp production and applications in Ohio. Current research activities focus on understanding production, processing, and new uses for hemp. He has worked on a) the chemistry of hemp cigarettes and vape products; b) using hemp grain as a feed ingredient for fish; c) elucidating impacts of manure application to hemp; and d) evaluating varieties and breeding new hemp cultivars. Co-author of First place winner of IEOM international Conference, Lisbon, Portugal in Modeling and simulation competition 2023. Co-author of First place winner of IEOM international Conference, Sydney, Australia in Modeling and simulation competition 2024.