STEPHEN W. TSAI

Email: stsai@stanford.edu

EDUCATIONAL BACKGROUND

1961 D.Eng. in Mechanical Engineering, Yale University
1952 B.S. in Mechanical Engineering, Yale University

WORK EXPERIENCE

2001- Present	Professor Research Emeritus, Aeronautics and Astronautics, Stanford University
1992-2001	Research Professor, Aeronautics and Astronautics, Stanford University
1972-1990	Director of Mechanics of Composites, Air Force Materials Laboratory
1968-1972	Chief Scientist, Air Force Materials Laboratory
1966-1968	Professor, Washington University
1961-1966	Composite Materials Engineer, Aeronutronic
1952-1958	Engineer, Foster Wheeler Corporation

MAJOR ACCOMPLISHMENTS

Research by Stephen W. Tsai led to several formulas and failure criteria in composite materials bearing his name, such as Tsai-Wu, which have been implemented almost every commercial software. These criteria have also become standard textbook material and been referred in most of the research articles in design and analysis of composite structures. More recently, his discovery of trace and master ply for carbon composites led to the naming of Tsai's modulus, and double-double laminates.

There are several awards at international conferences on composite materials to honor his contributions in the field.

1967 Founding Editor of *Journal of Composite Materials*
1995 Life Member National Academy of Engineering
1998 Life Fellow of American Society of Mechanical Engineers
2010 Fellow of the Society for the Advancement of Material and Process Engineering
2025 Guggenheim Medal by American Institute of Aeronautics & Astronautics
2025 Spirit of St. Louis Medal by American Society of Mechanical Engineers

RECENT AND BOOKS AND PUBLICATIONS

Design of Composite Laminates, with Daniel Melo and others, Stanford Composites Design Group, 2017

Composite Double-double and Grid/skin Structures, with Naresh Sharma, Albertino

Arteiro, Surajit Roy, and Robert Rainsberger, Stanford Composites Design Group, 2019

Double-double, with Erik Kappel, Antonio Miravete and others, Stanford Composites Design group, JEC and Stanford, 2022

Double-Double, second edition, Stanford Composite Design Group, 2023

RECENT PUBLICATIONS

1) Bruno Vermes, Stephen W. Tsai, Aniello Riccio, Francesco Di Caprio, Surajit Roy, "Application of the Tsai's Modulus and Double-Double concepts to the Definition of a New Affordable Design Approach for Composite Laminates,", Composite Structures, October 2020, 113246 .
2) Albertino Arteiro, Naresh Sharma, Jose Daniel, D.Melo, Sung KyuHa, Antonio Miravete, Yasushi Miyano, Thierry Massard, Pranav D. Shah, Surajit Roy, ..., H. ThomasHahn, " A case for Tsai's Modulus, an invariant-based approach to stiffness," Composite Structures, Volume 252, 15 November 2020, 112683.
3) S.W. Tsai, "Double-double: new family of composite laminates," AIAA Journal, vol 59, No. 11, November 2021

A LIFE-LONG ACCOMPLISHMENTS IN ADVANCE COMPOSITES

Over 60 years, he has provided leadership to improve competitiveness of composites design, testing and manufacturing through science-based models and simulation tools to help research, training and education of engineers. He expects that composites will further fulfill their unique destiny in reduced weight and cost, unmatched durability and reliability of structures, not possible with metals. His invariant failure theory, known as Tsai-Wu, is embedded in almost every commercial finite element code. His invariant-based theory will further simplify design, testing and manufacturing, as described in his 2015 book, and with further improved method of laminate design in his more recent books (2019 and 2023). In these books, a new double-double helix family of laminates can replace the legacy quad with a fraction of the thickness and forms the basis of both solid laminated and grid/skin structures. These structures have inherent damage tolerance, and unmatched weight and cost savings. In 2020, his peers decided to name his discovery of trace for the master ply of CFRP the Tsai's modulus. It is beginning to be realized that the quad laminates for the last 60 years have brought severe burden on their use because such laminates are heterogeneous (stacking sequence dependent) and anisotropic (non zero shear coupling). Such complicated lamination has led to design that is slow, costly and uncertain. With double-double being homogeneous and orthotropic, a drastic simplification in design, weight saving, and manufacturing become possible. His notable discovery of two single parameters for laminate stiffness in trace, and average laminate strength of the failure envelope has made possible the rating and scaling of composite materials and laminates. The transformational change is making composites more competitive and fulfilling their long anticipated destiny. His most recent discovery of Metalite will continue his quest to make composites simpler and better.