

Topology optimization – from research to broad industrial impact

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Abstract: This talk will provide an overview of the emergence of topology optimization and its evolution over the past two and a half decades into a widely applied technology. It will highlight key insights into essential factors for broad industrial adoption, including (1) incorporating practical design requirements across different industries, (2) integrating manufacturing constraints, and (3) developing comprehensive engineering processes and software solutions. Key technical aspects will be revisited, and the far-reaching industrial impact of topology optimization will be illustrated through real-world applications.

Bio: Dr. Ming Zhou's career spans both academic research and engineering software development. He currently serves as Chief Engineer at Altair Engineering, where he is responsible for software solutions in computational mechanics and design optimization. A driving force behind the success of Altair OptiStruct, Ming played a key role in spearheading the industrialization of topology optimization, creating a profound impact across major industries. Simulation-driven generative design has become a crucial technology for lightweighting aircraft, automobiles, and other transportation vehicles, contributing significantly to sustainability efforts and the fight against climate change. Before joining Altair in 1998, Ming was among the pioneering researchers of topology optimization. He was one of the original authors of the SIMP method for topology optimization, and his latest innovations include the fail-safe topology approach. His contributions to the research community extend beyond his technical work – he currently serves as Editor-in-Chief of Structural and Multidisciplinary Optimization, the official journal of the International Society of Structural and Multidisciplinary Optimization (ISSMO). Ming has been honored with election to the U.S. National Academy of Engineering, Class of 2025 (#NAE2025), *'for contributions to topology optimization and simulation-driven generative design technology.'* As he noted on LinkedIn, this recognition truly belongs to Altair, the Structural and Multidisciplinary Optimization research community, and the many giants he has had the privilege to work with. He remains committed to advancing the impact of the SMO research field and the simulation-driven generative design technology.