

Welding Science as an Engineering Skill; Part 1, distortion and residual stress

Mahyar Asadi

This lecture mainly presents the scientific advancements and available capabilities in control of distortion and residual stress, and demonstrates that a weld can be made with essentially zero distortion and zero residual stress. This goes beyond the routine industrial practice of welding engineering in control of distortion and residual stress that is generally limited to intuition-based designs for tack welding and static clamping, and shows designer-driven optimization of the design of welded structures is now feasible for routine engineering in industry, and computer simulations are enabling tools to help users' apply their creativity, expertise and skill to be more productive and innovative. The lecture also includes techniques such as pre-bending, side heating, trail cooling, live clamping, and adaptive control that are now becoming practical due to the recent developments in advanced welding simulation that offers automated frameworks to support multiple analyses of welded structures including thermal, microstructure, and mechanical analysis. The lecturer believes the lack of computational-welding skills for welding engineers is an opportunity to improve current educational programs for welding and engineering of welding in industry.