

NSF CAREER: INNOVATIVE RESEARCH AND TEACHING IN MODERN WELDED STRUCTURES ENGINEERING AND DESIGN

Welded structural members have been a very important factor in our economy. The widespread use of welded connections in the construction and transportation industries is because the welded design achieves, among other things, an efficient use of materials and a high speed of fabrication. In spite of this vast application of welding technology, students in engineering (especially mechanical and civil) are seldom formally educated in the science of welding and its applications in technology. Moreover, there is a need to establish the linkage between mechanics, materials science, and structures in the context of welded structures in the engineering curricula. Such linkages are becoming increasingly necessary and common in industry, while they are disappearing from the engineering education.

This proposal seeks to answer the above-mentioned deficiencies that currently exist in the education of engineers in the areas of applied mechanics, materials science, and industrial technology. These deficiencies will be remedied through a *new course* on “Welding Engineering and Design of Welded Structures”.

The research will focus on the *prediction of durability of spot welded sheet metal structures and their degradation during their life cycles*. These structures are very widely used in the transportation industry, especially the automobile and also the aircraft industry. It is envisaged that the techniques developed and results obtained can be extended to other welded or mechanically fastened (e.g., riveted) structures, while significantly benefiting the transportation industry.

Prediction of the remaining service life of an automobile or aircraft body due to fatigue, fractures, residual stresses, resulting loss in stiffness, etc., and the interaction between these phenomena is challenging and little understood. For example, we seriously lack in the understanding of the mechanical response and durability of spot-welded sheet metal structures under dynamic service loads. A fundamental understanding and development of failure criteria and design criteria for such structures will be immensely beneficial.

Objectives (Capabilities)

- Develop a *new course* on “Welding Engineering and Design of Welded Structures”.
- Develop a fundamental understanding of failure mechanisms in spot welded structures
- Expand the frontiers of knowledge on failure in thin sheet metal welded structures
- Improve the usable life of automotive and aircraft structures

Application areas/Agencies

- Civil infrastructure
- Transport industry

Point of contact:

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