Robust Temperature Control in Friction Stir Welding

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Executive Statement:

This thesis presents a novel algorithm for precise temperature control in Friction Stir Welding to enhance weld quality and extend tool life.

Technology Overview:

The document details the development of a dual-loop control system designed to improve temperature management during Friction Stir Welding, specifically using polycrystalline cubic boron nitride tools. By focusing on maintaining constant power and adjusting power based on temperature feedback, the research aims to achieve more consistent welds and reduce wear on tools.

Key Advantages:

- Dual-loop control system for enhanced temperature precision
- Effective power and temperature management to improve weld consistency
- Use of first-order models with time delay for accurate temperature prediction
- Experimental validation showing temperature maintenance within a narrow range
- Improved PID tuning methods for stable and optimized control

Problems Addressed:

- Inconsistent weld quality due to temperature fluctuations
- Increased tool wear from poor temperature control
- Lack of effective temperature control algorithms for FSW, particularly with PCBN tools

Market Applications:

- Manufacturing industries utilizing Friction Stir Welding
- Quality control systems for welding processes
- Development of welding equipment with integrated temperature control
- Research and development in advanced welding technologies