Aluminum Plate Stretcher Flow Stress Prediction Proposal

Problem Statement

AlumaTech requires a reliable method to predict flow stress in aluminum plates during the stretching process. Currently, the company cannot accurately forecast the pull forces needed for new plate products before production, leading to potential equipment damage, quality issues, and inefficient resource allocation.

Context

Aluminum plate stretching is a critical manufacturing process that significantly affects product quality. Flow stress values vary considerably based on alloy type, plate geometry, and processing conditions. AlumaTech has compiled extensive historical data (over 500,000 records spanning 10 years) from their stretcher operations that can be leveraged to develop predictive models. By accurately forecasting pull forces and flow stresses, AlumaTech can optimize production scheduling, improve preventive maintenance practices, and enhance product quality through more precise stretching parameters.

Criteria for Success

- Development of accurate predictive models for flow stress across all key alloys and geometries
- Ability to evaluate feasibility of new product development initiatives before committing production resources

Scope of Solution Space

The solution will focus on analyzing historical data to develop mathematical models that predict flow stress based on material properties and processing conditions. This includes:

- Analysis of relationships between plate geometry, alloy type, and required stretch forces
- Development of trendlines for specific gauge-alloy combinations

Constraints

- Analysis limited to alloys and gauge ranges present in the historical dataset
- Accuracy dependent on quality and comprehensiveness of historical records
- Environmental factors (temperature, humidity) may not be fully captured in historical data
- Model assumes consistent material properties within defined alloy specifications

Stakeholders

- Engineering team: Will use the predictive tools for new product development and process optimization
- Finance/Procurement: Uses predictions to evaluate new product feasibility and resource planning
- Quality assurance: Benefits from optimized stretching parameters for improved product consistency

Data Sources

Three key datasets from existing stretcher operations will be utilized:

1. Historical Stretch Data (369,547 stretches from 2007-2018): Allows analysis of long-term trends and process changes that have affected typical flow stress values