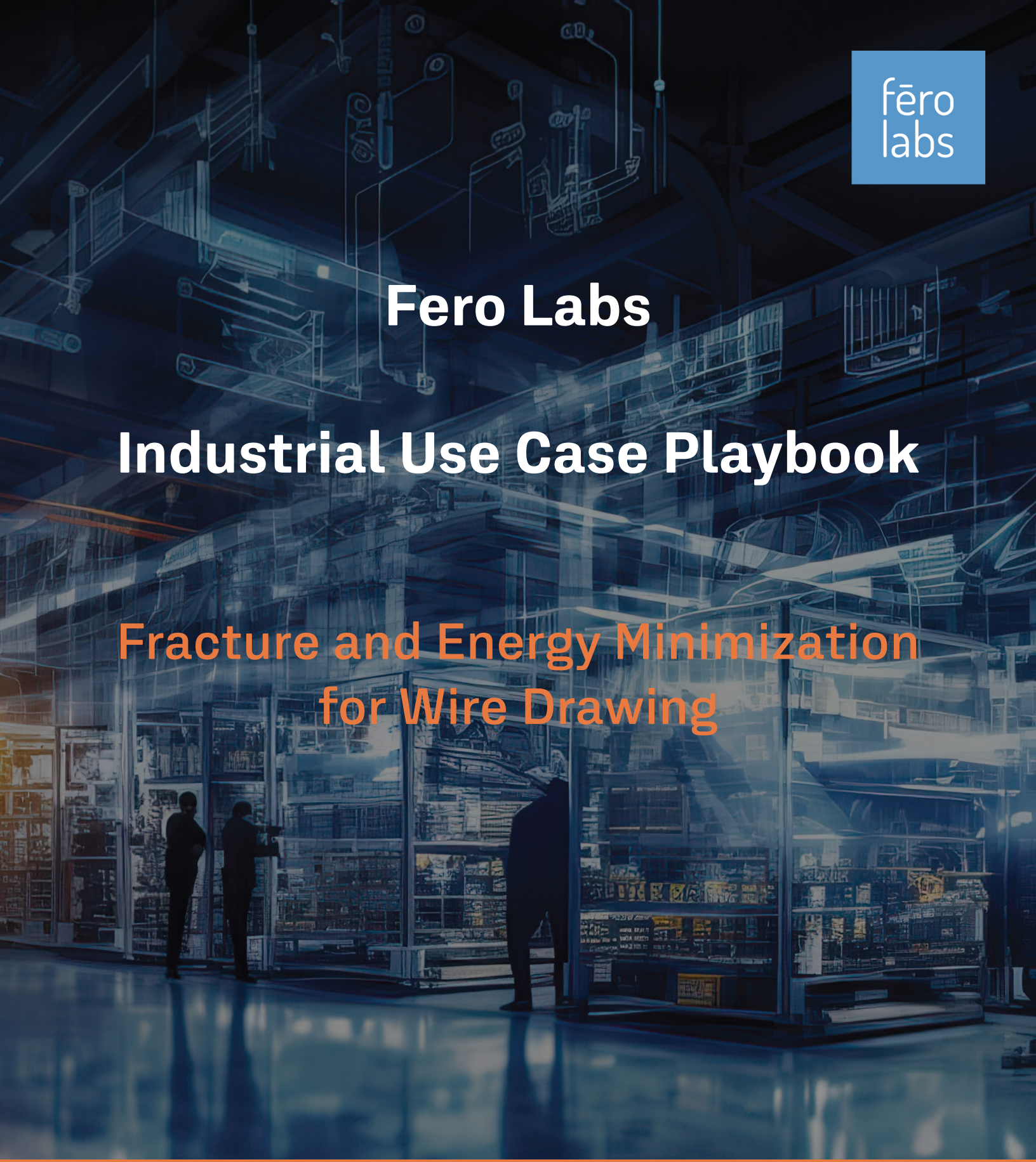


Fero Labs

Industrial Use Case Playbook

Fracture and Energy Minimization for Wire Drawing

Table of Contents

© Fero Labs 2024

Introduction

Welcome to the **Industrial Use Case Playbook**, crafted by **Fero Labs** for the forward-thinking professionals dedicated to enhancing factory production optimization.

Whether you're a Data Scientist, Process or Production Engineer, Metallurgist, or Plant Manager, this playbook is tailored to equip you with the strategies, insights, and tools necessary to drive transformative change within your organization.

In today's rapidly evolving industrial landscape, maximizing production efficiency and minimizing operational costs are imperative for maintaining competitiveness and sustainability.

Within each of our industrial playbooks, we present a curated collection of use cases designed to address the specific challenges faced by modern manufacturing facilities. Each use case is meticulously crafted to deliver tangible outcomes, ranging from increased productivity and quality to reduced waste and energy consumption to help achieve sustainability goals.

Featured within these pages is a use case which spotlights **Fracture and Energy Minimization for Wire Drawing**. This case exemplifies how to tackle complex production optimization challenges head-on, leveraging data-driven approaches to drive measurable improvements in operational efficiency and cost-effectiveness.

As you embark on this journey for operational excellence, we encourage you to approach each Fero Labs use case scenario with curiosity, a willingness to embrace innovation and change.

By harnessing the power of your production data, domain knowledge, and collaborative problem-solving, we believe that you can unlock the full potential of your factory's production capabilities.

Together, let's redefine what's possible in industrial manufacturing and pave the way for a future of unprecedented productivity and sustainability.

Welcome aboard,

Fero Labs

© Fero Labs 2024

Industry Overview

In the realm of industrial manufacturing, particularly within the wire drawing sector, optimizing production efficiency holds paramount importance in sustaining competitiveness and driving profitability. Wire drawing facilities, characterized by intricate processes and high-energy operations, face myriad challenges ranging from fluctuating market demands to rising operational costs and stringent quality standards.

Wire drawing serves as a critical process in various industries, including automotive, construction, electronics, and telecommunications. The global wire and cable market is projected to have continued growth, driven by increasing demand for electricity, communication, transportation, and infrastructure development worldwide.

However, the wire drawing process is inherently complex and resource-intensive, with significant energy consumption and material waste contributing to both economic and environmental impacts. Fractures and energy losses during wire drawing operations can lead to reduced product quality, increased scrap rates, and higher production costs.

One critical aspect of wire drawing optimization lies in minimizing fractures and energy losses during the process. Efficient management of drawing parameters, lubrication systems, and material properties is essential to maintain product integrity throughout the wire drawing process.

Optimizing fracture and energy minimization in wire drawing represents an imperative for manufacturers seeking to **enhance operational efficiency, reduce production costs, and improve product quality.**

By adopting data-driven approaches and advanced analytics techniques, wire drawing facilities can gain insights into optimal process parameters, mechanical property characteristics, and patenting strategies, enabling precise control over wire drawing operations while minimizing energy consumption and material waste.

Moreover, in an era marked by growing sustainability concerns and regulatory pressures, optimizing production efficiencies not only yields economic benefits but also aligns with broader environmental objectives.

By reducing energy consumption, minimizing raw material usage, and optimizing waste management practices, steel plants can demonstrate their commitment to sustainable manufacturing practices while enhancing their bottom line. At Fero Labs, we refer to this as Profitable Sustainability.

© Fero Labs 2024

Industry Challenges

In Industry 4.0, the promise of digital transformation often gets stuck in **"pilot purgatory,"** with **70% of initiatives failing to progress beyond testing phases**. McKinsey's research highlights that the choice of use case significantly impacts this phenomenon.

Selecting use cases that lack strategic alignment, clear value propositions, or encounter technical barriers contributes to pilot initiatives' failure.

Pilot purgatory not only wastes resources but also risks eroding confidence in digital transformation efforts. To navigate this challenge, organizations must strategically select use cases closely aligned with their objectives, offering clear pathways to value creation and scalability.

In each **Fero Labs Use Case Playbook**, we explore industrial use cases designed to address modern manufacturing challenges. Leveraging advanced analytics, AI, and machine learning, these use cases aim to drive tangible improvements in operational performance, cost-effectiveness, and sustainability.

By focusing on strategic and transformative use cases, organizations can break free from pilot purgatory and unlock new opportunities for growth and innovation.

© Fero Labs 2024

Use Case Description

Background

Steel wire drawing involves pulling steel wire through progressively smaller dies to reduce its cross-sectional area. Typical steps involve heating, rolling, lubricating, drawing, patenting or annealing, and plating or galvanizing. Steel wires and filaments have myriad uses in the construction, automotive, agriculture, and other industries.

Problem

Minimizing fractures in steel wire drawing is a challenging task. Non-metallic inclusions in steel wire rods can lead to fractures during the drawing process, which cause scrapped production. **Adapting to non-metallic inclusions** and other feedstock variability is difficult because **hundreds of process parameters** affect final wire quality metrics, such as breaking force, tensile strength, and elongation. Moreover, minimizing the energy and electricity consumption during annealing, patenting, plating, and galvanizing process stages can interfere with quality objectives.

Process and quality engineers operating wire drawing processes must actively trade off scrap rates with production efficiency. Measuring the precise nature of non-metallic inclusions can be impractical, making it unclear how to adapting process parameters during production.

Problem Summary

Minimize fractures and energy consumption by adapting to non-metallic inclusions in feedstock and targeting process changes in energy-intensive process stages.

The current solution is to define production set-points based on product grades, ideally with some static adjustment based on feedstock steel cleanliness measurements. These frequently advocate sub-optimal die angle and patenting set points, which results in:

- financial loss due to fractures in final product and unnecessary heat and electricity consumption, and
- environmental cost of incurring Scope 2 and 3 emissions due to wasted energy and scrapped product.

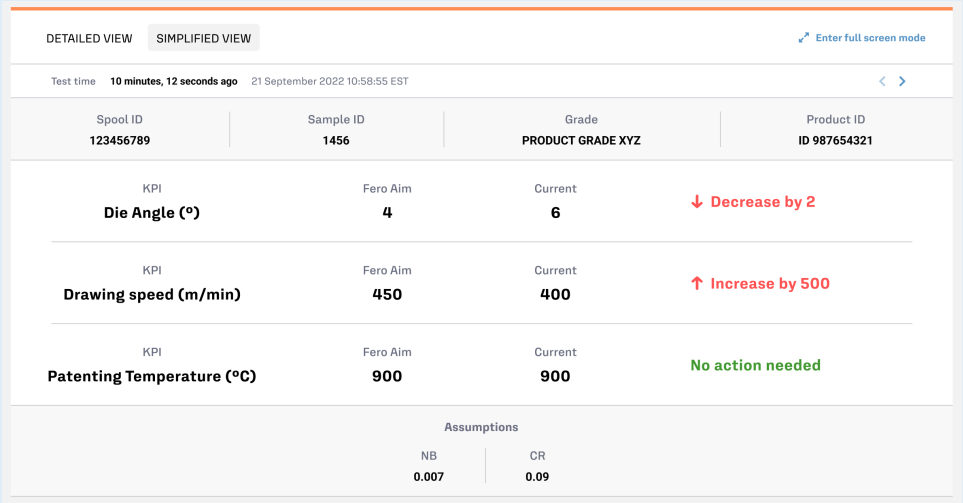
© Fero Labs 2024

Fero Solution

Wire drawing facilities can use Fero Labs software to minimize the risk of fracture and target low energy consumption while ensuring that breaking force, tensile strength, and elongation KPIs are kept with product specifications. Worst-case downstream drawing parameters can be used to minimize risk of product re-grades and fracture scrap.

A Live Fero Analysis for this use case presents two screens:

- Detailed View: for **production and quality engineers** to monitor production and take action at any moment
- Simplified View: for **operators** on the factory floor, with critical information clearly presented.



© Fero Labs 2024

Process & Business Outcomes

Tightened variation of end-of-line mechanical properties

With Fero Labs providing optimal recommendations based on available non-metallic inclusions of feedstock steel rods, steel cleanliness no longer translates to end-of-line mechanical property variation. Since each spool is optimized to meet its specific quality metrics relative to its specific upstream quality measurements and process set points, breaking force, tensile strength, and elongation measurements become more stable.

With a full adoption of Fero Labs software on the production line, wire drawing facilities can see up to **15% reduction** in mechanical property variability, within production grades. Knowing that production will reliably meet its specifications leads to smoother operations.

Reduced risk of production regrades and fracture scrap

With high-grade steelmaking, fractures can be challenging to minimize. Even though non-metallic inclusion measurements may not be fully comprehensive, Fero can optimize production parameters, such as drawing die angles and patenting temperatures, to minimize risk of fractures. With Fero optimizing each spool based on its cleanliness properties, wire drawing facilities can expect up to a **25% decrease** in scrap and regrade rates.

Measurable cost savings from minimizing energy and electricity

Static recipes for product grades lead operators to patenting, plating, and galvanizing set-points that consume unnecessary amounts of energy. With Fero optimizing for production cost, while maintaining stability of end-of-line mechanical properties, operators can minimize temperatures and currents at key stages during production.

With a full adoption of Fero on the production line, wire drawing facilities can expect up to **3% cost savings** in electricity consumption.

Commensurate Scope 2 and 3 carbon footprint minimization

The minimization of fracture tackles the tricky problem of reducing Scope 3 emissions. Additionally, any reduction of energy and electricity consumption carries a commensurate reduction in Scope 2 emissions. Directly addressing the objectives above can reduce the carbon footprint of production by **up to 15%**. Fero can provide reporting capabilities that directly track and account for this reduction.

© Fero Labs 2024

Fero Labs Adoption Timeline

Wire drawing facilities with specialized teams can collaborate to set up and deploy Fero. Below is a timeline highlighting typical steps. With Fero's easy-to-use, no-code interface, this can be achieved in a matter of weeks, not months or years.

Time	Process & Quality Engineers	Data Scientists / IT	Operators	Management
Week 1	Pull data	Pull data		
Week 1	Upload to Fero			
Week 1	Configure Fero	Configure Fero		
Week 2	Corroborate results	Receive example report showing accuracy		
Week 2	Set up Fero Optimization	Set up Fero Optimization		Receive example report showing savings
Week 3	Live data connection	Live data connection		
Week 3	Live Optimization screen (Detailed view)		Live Optimization screen (Simplified view)	
Going forward	Monitor deployment		Follow Fero Optimization recommendations	Receive regular reports showing savings
Going forward	Run "what-if" scenario simulations, spot check production, run root cause analyses		Follow Fero Optimization recommendations	Receive regular reports showing savings

© Fero Labs 2024

Use Case Data Requirements

The Fero Labs Platform has convenient integrations into common process information management systems, such as Aveva PI System, AspenTech, Wonderware, and SQL databases, as well as laboratory information management systems, such as SAP, Oracle, and other ERP systems. Initial data exploration can be done either through direct integration into these services, or data file uploads in Excel and CSV data formats.

The data requirements for this use case typically involve the following sources, all indexed by spool or production ID:

Feedstock non-metallic inclusion inspection data

- Number, size, and ideally types of inclusions per spool, averaged over multiple samples.

Feedstock chemistry data

- Percentage weight chemical composition of each spool.

Fracture measurement data

- Length, number of fractures (normalized), product type, grade, etc.

Mechanical property measurement data

- Ultimate tensile strength, yield strength, elongation measurements per spool, potentially at different locations, averaged in MPa, PSi, or KSi. (Optional) torsion data.

Production set-points and process parameters

- Die information, drawing speeds, patenting temperatures, plating parameters, etc.

For detailed specifics on ideal data requirements for this use case make a time to chat with our team.

© Fero Labs 2024

Activating This Use Case

Consider our **Industrial Use Case Playbooks** as inspiration and tactical ideas for your team to align on to maximize the efficiencies of your plant. Each Playbook has a matching **Use Case Blueprint** which provides detailed steps to activate each use case within the Fero Labs platform.

If you're curious to see these in action please book a use case demo with our team!

Together, let us continue to push the boundaries of what's possible, driving towards a future where industrial manufacturing is not just efficient and sustainable but truly transformative in its impact on society and the world at large.

Thank you for joining us on this journey, and we look forward to continuing to partner with you in your pursuit of excellence.

Sincerely,

Fero Labs

About Fero Labs

Fero Labs helps factories work better together by bridging the gap between the disconnected goldmine of production data and industrial knowledge inside every plant.

The Fero Labs Augmented Intelligence Platform collects data and knowledge, and augments it with powerful Fero ML so factories can make more confident changes that drive profit and sustainability.

Harnessing Fero Labs, a factory creates an augmented workflow which allows for better use of raw and recycled materials, production time, and energy utilization. Teams can work 90× faster, using Fero's AI powered simulated predictions or live optimizations. They can run root cause analyses in minutes, and make continuous process improvements that drive Profitable Sustainability.

Fero Lab's white-box explainable ML makes decisions clearer by showing the context and confidence levels behind every prediction and recommendation. This expands a plant's production knowledge and drives better production results for manufacturers, all while minimizing emissions. Together we'll build a sustainable tomorrow.

© Fero Labs 2024