



METALS
ADVANCED
FURNACE CONTROL (AFC)

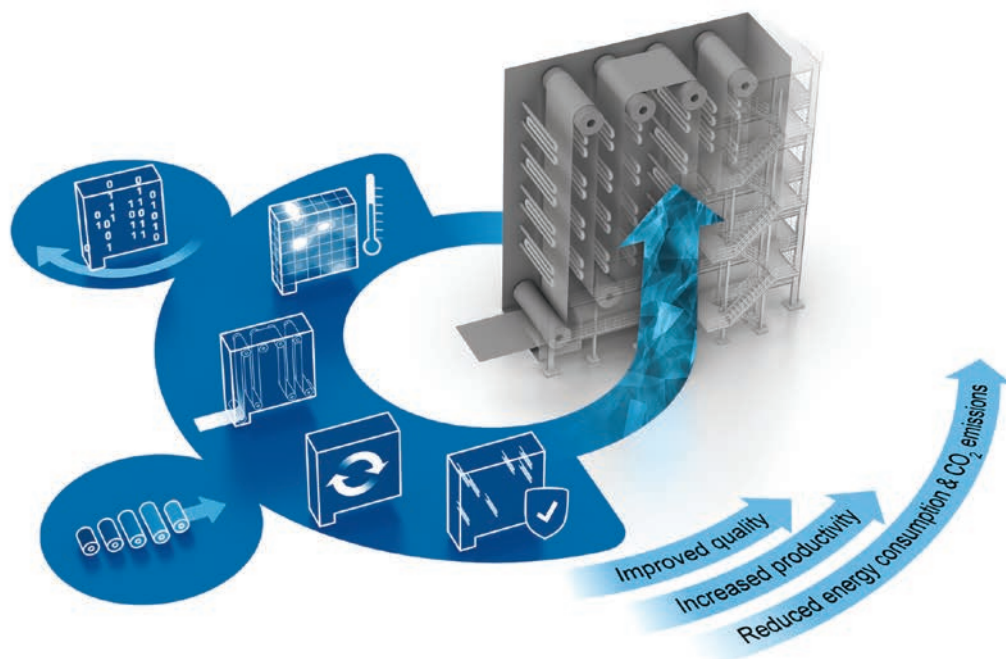
MODEL-BASED PREDICTIVE CONTROL

ANDRITZ

ENGINEERED SUCCESS

Why we need a new approach

Like never before, production companies are under increasing pressure from the market. The world has accelerated, conditions are changing on a daily basis, and customer expectations are high. In order to survive in the market, modern companies must respond to challenges such as high demands on quality and productivity, while taking sustainability and environmental impact into account at the same time.



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BETTER PROCESS CONTROL

To meet the market demands, ANDRITZ has created an innovative solution for controlling annealing furnaces – Advanced Furnace Con-

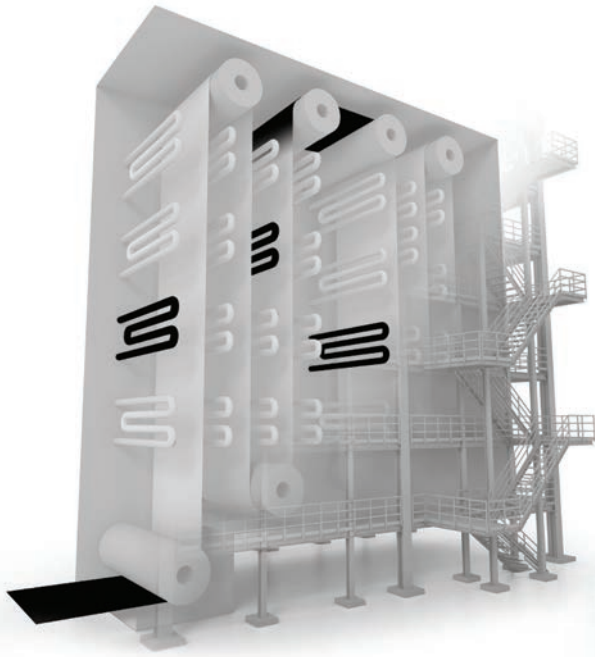
trol (AFC). AFC is a software product that enables better control of the heating and cooling process while providing an accurate prediction of temperatures at the same time. Although new and innovative, AFC technology is already well-proven – technology leaders in the metals industry are using AFC in their manufacturing processes.

Annealing furnaces are used in the metals industry to change material and surface characteristics. To achieve the required product characteristics, the material must be heated according to a predefined temperature trajectory. Tradition-

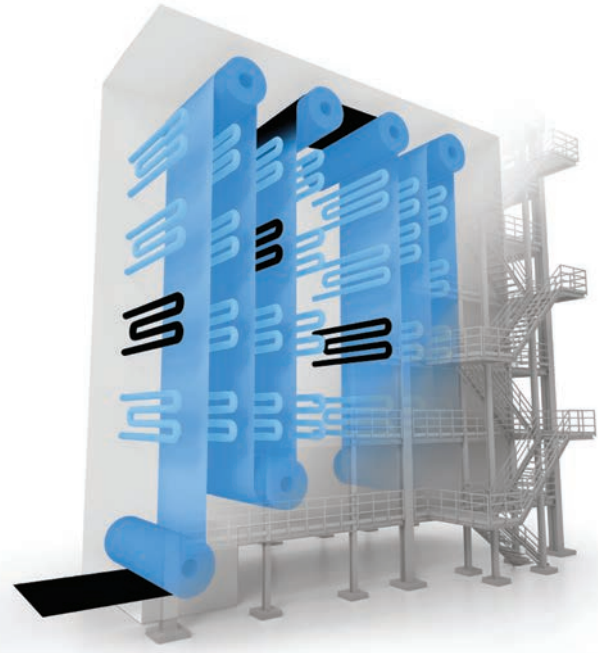
al control concepts have reached their limits and are not performing well enough due to the high thermal inertia of the furnace, the limited number of temperature measurement points, and the increasing diversification of product portfolios.

REDUCED ENERGY CONSUMPTION

The new control concept that facilitates the consideration of all these challenges uses model predictive control of the temperature. It is suitable for complex systems, such as annealing furnaces, and allows such goals as increase of throughput, minimization of energy consumption, and minimization of CO₂ emis-



■ Actually measured



■ Calculated by the mathematical model

sions to be incorporated.

The basis of the AFC is a physical furnace model comprising four sub-models: convection, radiation, conduction, and combustion. These models are used to capture the thermal behavior of the furnace accurately and to provide exceptional accuracy of calculated strip temperature inside the furnace.

The AFC consists of three basic modules: Observer, Model Predictive Control (MPC), and Trajectory Planning. Optional modules are a Furnace Simulator and a Planning Optimizer. The Observer module estimates the actual temperature distribution and discovers unknown material characteristics. The Model Predictive Control solves a non-linear optimization problem with respect to defined control goals. Typical goals are accurate control of temperatures, maximization of

the throughput, or minimization of the energy consumption. The Trajectory module is used by the operators to manage target trajectories of the strip temperature and limits for the system inputs.

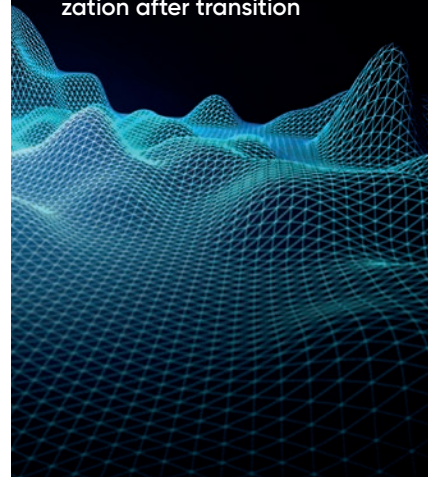
With the optional Planning Optimizer, the production schedule is optimized to minimize the use of transition coils. The optional Furnace Simulator can be used to verify new products and verify heat-up curves before applying them to a real furnace. Due to the specific modular and flexible design, AFC can not only be applied to any directly or indirectly fired furnace, but also to any cooling section.

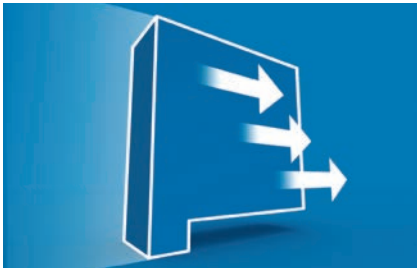
AFC has been implemented successfully in plants around the world, even on AHSS lines, revamps, and competitors' furnaces.

Benefits

METRIS ADVANCED FURNACE CONTROL

- Accurate strip temperature at any point, even where measurement is not possible
- Minimization of transition time, fewer transition coils
- Intuitive touch-enabled user interface
- Furnace protection by reducing heat buckling and the possibility of rolls sliding
- Accurate control of temperatures, also during transitions
- Very fast temperature stabilization after transition

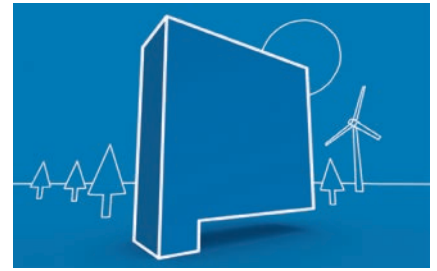




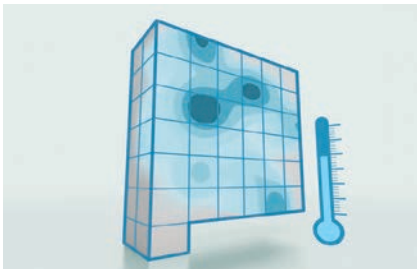
Increased productivity



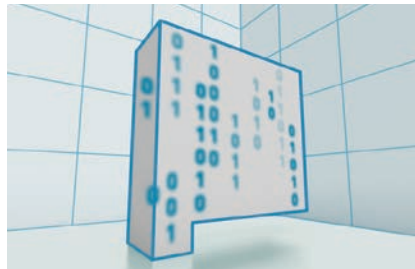
Improved quality



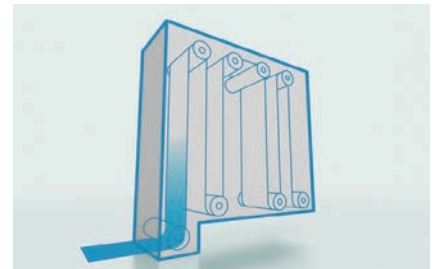
Reduced energy consumption and CO₂ emissions



Temperature control and prediction



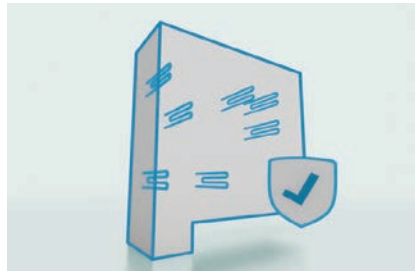
Furnace simulator



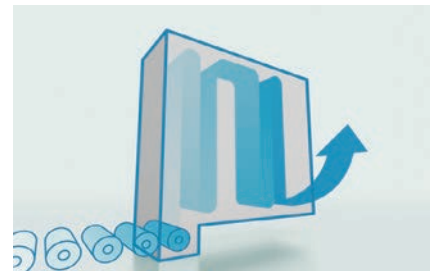
Short transition time



Full automatic mode



Tube overheat protection



Planning optimizer

ANDRITZ - YOUR PARTNER

We appreciate to walk down the supply chain with you to value added products. We have the right technology for your needs.

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