

Modelling and control (level 2) of entire furnaces

Research and development analysis and findings

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Topic

- *Modelling of entire furnace, model based predictive control (level 2)*



Specific

- Whole furnace (furnace zone model, concentrated parameters model)
- Burners (Computational Fluid Dynamics, Combustion simulation)



Aims

- Improve the regulation and control of the furnace
- Simulating scenarios in advance and the testing of new procedure



Research of past 25 years

Main research topics and achievements



- Energy consumption
 - Decreased through ideal heating curves
 - Reduced gas consumption: based on dynamic temperature control: 4 to -12 % depending on production rate



- Productivity increase
 - + 2% for stainless steel reheating
 - Improvement of the process efficiency (not quantified)



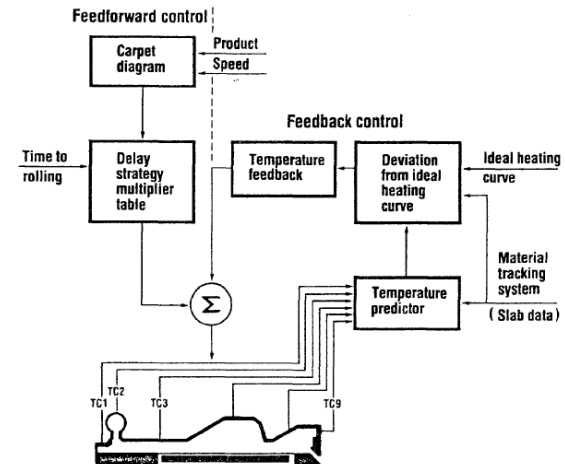
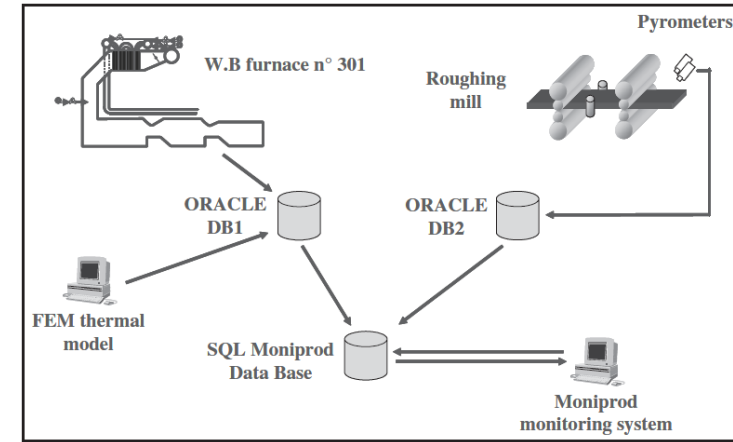
- Scale loss of product
 - Early detection of anomalies and timely identification of possible causes (not quantified)



Research of past 25 years

Success stories

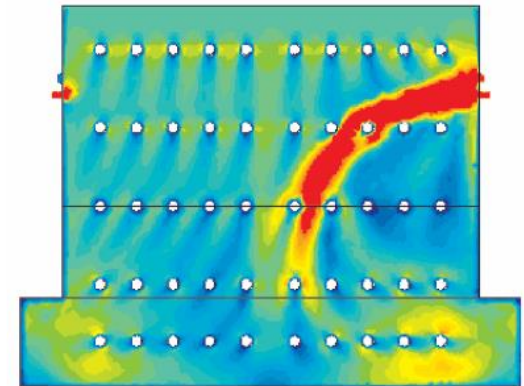
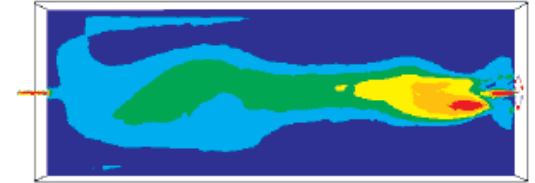
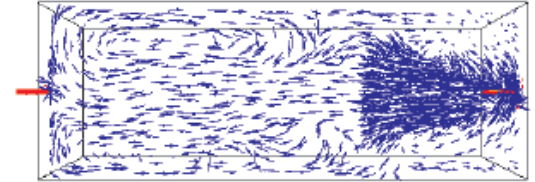
- Two intelligent **monitoring and guidance systems** for the optimized operation of reheating furnaces, based on **artificial intelligence** ([link](#))
- **Correct distance between slabs checking** by a system based on **statistical evaluation** of temperature maps provided by scanning pyrometer ([link](#))
- A **flame analysis system** capable of predicting burner characteristics, imbalances and fault conditions ([link](#))
- **Development and validation of various dynamic model (zonal approach)** ([link](#))
 - Implementation of improved strategies and improvements of furnace controller software



Research of past 25 years

Success stories

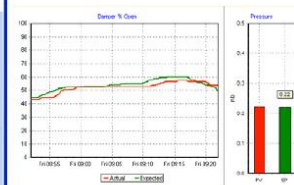
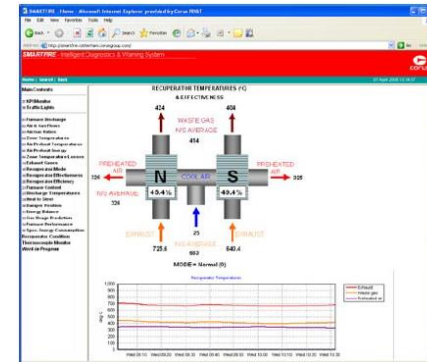
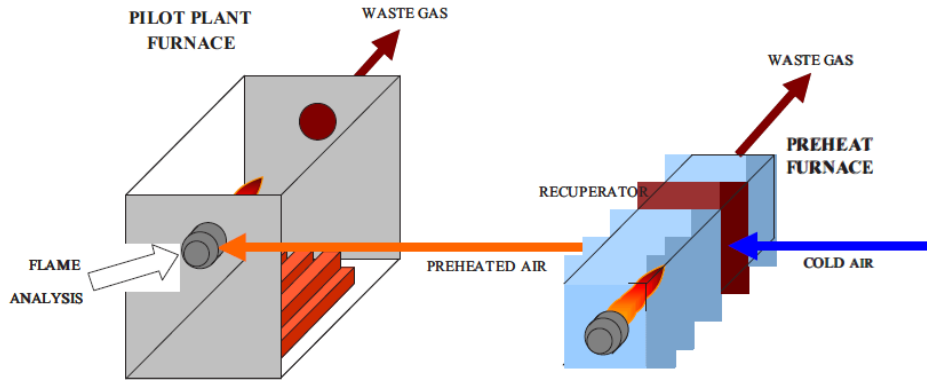
- **CFD furnace model** (Pilot-scale and Full-scale furnace mode) ([link](#))
- **CFD MILD combustion simulation** with a variety of fuels (hydrogen, ammonia, methane and their mixtures) ([link](#))
 - Kinetic scheme reduction and inclusion in large scale simulation.
 - mechanism reduction, machine learning, efficient chemistry management.
- **Detailed kinetic mechanism for combustion of natural gas** development in conventional and non-conventional systems ([link](#))



Research of past 25 years

Follow-up projects

- The **flame monitoring system** is being further developed, investigating the use of low-cost flame monitoring systems for the optimization of the combustion of power station utility boilers when co-firing coal and biomass.





Thank you for the attention!

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