IAS the achievers

envoy

DECEMBER, 2005

Christmas Greetings from *the achievers* to All Our Friends at Christmas

As Christmas approaches our thoughts turn to the joy of family celebrations and we look back on the blurred events of the past year, amazed that the year is nearly over.

For ***the achievers*** at IAS it has been a year of hard work, consolidation of the business, success in the battles of industry and modest technical achievement in pushing back the knowledge frontier. We thank you for allowing us to share your challenges and look forward to continuing these efforts in the New Year.

On behalf of our staff in Pittsburgh and in Teralba we wish you and your families a peaceful, relaxing and enjoyable celebration of the Christmas season.

"May There be Peace on Earth and Goodwill To All"

INSIDE:

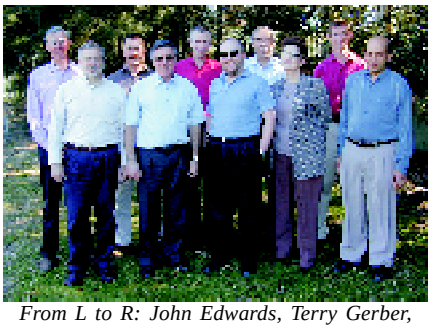
A BUSY TWELVE MONTHS:

The last year has seen a consolidation of the steel market and rising zinc prices are putting pressure on galvanizers to improve the efficiency of their coating operations.

IAS has been fortunate to secure a number of automation projects and consulting contracts around the world.

This has seen our engineers spending considerable time in Australia, China, Mexico, the Philippines, South Africa, Taiwan and the USA. We are in the process of supplying our first automation system to the Ukraine.

In addition, the Institution of Engineers Australia presented us with a second Engineering Excellence Award, this time for an innovative setup model implemented on the BlueScope Steel Western Port hot strip mill.



From L to R: John Edwards, Terry Gerber, Peter Steigler, Ray Davies, George Voss, Tim Meakin, Graham Conway, Lella Starke, Glen Wallace, Tino Domanti

FLATNESS AND PROFILE CONTROL FOR HOT MILLS:

Competition amongst metal producers has created an environment where better full sheet thickness and flatness is an increasingly important trend. This has motivated recent innovations in instrumentation, actuation and automation within hot mill facilities aimed at improving thickness profile control for flat sheet which will be the topic of this brief discussion.

Strip profile interacts with final quality in the following ways. Firstly, stringent thickness tolerances required by modern automated manufacturing plants has meant that the variation in thickness across the strip width has taken up a significant portion of the available tolerance (typically ± 3% or less). By rolling strip with less thickness profile variation, say 0.5% instead of 2.0%, we create a significantly greater margin for the cold rolling thickness controller. This can be important as a much greater cold mill investment is required to achieve a thickness tolerance of say ±0.75% than ±1.25%.

As can be seen in Figure 1 the combination of the cold rolling thickness tolerance, the mean thickness profile and the three sigma +ve variation of strip profile must sum to less than the final customer tolerance if we are to supply appropriate product.

The second major interaction between the strip profile, downstream quality and product yield is in the area of flatness. If the strip profile produced in the hot mill

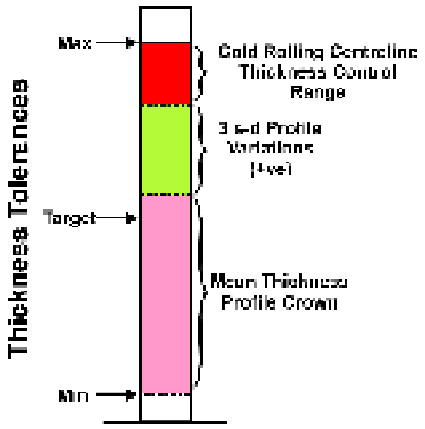


Fig. 1 Relationship of Strip Profile to Thickness Tolerances

cannot be matched by the loaded rollgap occurring in the cold mill, then a flatness defect will be generated. Hence, our ability to detect and control abnormal profile defects such as ridges, hollows, thick edges, and wedge at their hot mill source is crucial to final product flatness.

Investigation of thickness profile variations arising from process disturbances or profile control actuator changes reveals that the bulk of the induced variation occurs in the strip edge regions.

Generally the prevailing conditions in the rollgap are considered to be plane strain. However, near the strip edges, a number of localized effects modify the rollgap behavior, causing the transverse flow of the strip and a consequent tendency towards more profile change, as shown in Figure 2. These effects include:

- The transition to plane stress deformation at the strip edge.
- The rapid changes in the thermal camber and roll flattening around the strip edge.
- In plane shear stresses in the strip, which oppose the spread.

The combined effect of these factors determines the change in edge profile. In addition material creep, which occurs when rolling with tension at elevated temperatures, will also alter the final profile.

Before we are able to design and implement a successful profile control scheme we must combine a thorough understanding of these physical behaviors with knowledge of two other critical factors:

- What effect does manipulation of our available actuators have upon the loaded rollgap profile?
- What effect a change in the profile across a given roll bite will be on the resultant strain and buckling behavior in the strip?

FLATNESS AND PROFILE CONTROL FOR HOT MILLS: (Cont'd)

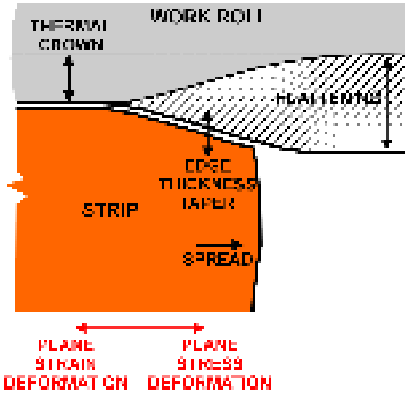


Fig. 2 Physical Influences on Profile at Strip Edge

Within the space of the previous few paragraphs we can see the areas requiring accurate model technology for profile control automation. It is now practical to execute all of the appropriate models described above within a mill setup calculation, and appropriate elements within dynamic controls in an on-line automation system.

When such models are combined with a suitable actuator optimization strategy, we then have the setup and dynamic control automation elements required to properly utilize the information from profile gauges to direct the action of the actuators available on a modern mill.

Profile and flatness instrumentation has made significant advances during recent years with multiple x-ray sources and detector units now capable of providing thickness profile feedback with a transverse resolution of better than 10mm at sub-second update rates. This has significantly enhanced the information available for dynamic control of profile over that obtained from old style scanning gauges. It also has improved the mill set up and adaption, allowing more accurate estimation of the state of the mill and, consequently, reduced the variation in the final strip profile and flatness.

Work roll bending has been the main actuator for profile control, often combined with a crown modifying actuator, such as side shifting variable crown, to mention one of many. However, with the improved information available from profile gauges, the manipulation of segmented spray headers and hot spray headers with a 50mm spacing is now a realistic option, allowing significantly improved profile control in the strip edge region.

The resulting integrated instrumentation, actuation and automation solution for a hot line is shown in Figure 3. The operating stability provided by such a configuration allows the optimization of various ground crowns and roll chamfers to assist in maintaining the actuators within their operating limits.

The adoption of the technology outlined in this brief discussion can be reasonably expected to more than halve the profile variation experienced. The benefits of such a strip quality to hot mill and downstream operations are considerable. Most importantly, the approach can be achieved with relatively minor capital expenditure.

This allows a reasonable return on investment for both inclusions in new facilities and in retrofitting existing facilities whenever the need to produce world class material exists.

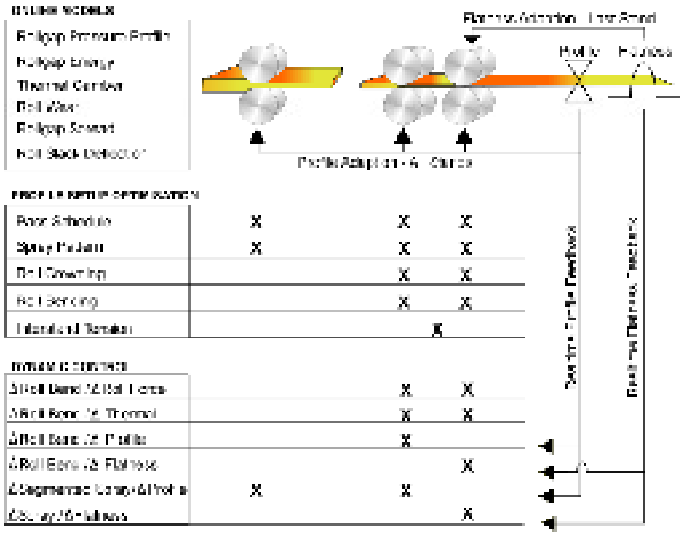


Fig. 3 Integrated Instrumentation Actuation and Automation Solution for Profile

.....BACK CHAT.....BACK CHAT.....BACK CHAT.....

IRTC will return to Greece from 7 to 12 May 2006.

Come to IRTC 27 and, not only will you visit the fabulous city of Athens, but you will get the best flat rolling education possible in just 5 days.

Daniel Saffer from Alcoa USA said of IRTC 26: *"An excellent course with a rich mix of modelling, control and practical expertise."*

IRTC provides you with superior documentation, professionally run training and return on investment. Read the references on our website for comments made by graduates.

Atul Tiwari from California Steel said: *"I attended IRTC for a second time after 10 years. I have learned more than expected. The documentation and presentation have vastly improved. The IRTC Faculty has further increased their skills to explain difficult concepts in simple ways. Anyone who has attended IRTC in the past should definitely consider attending again."*

Yes, IRTC continues to improve and ex-delegates can return for half price.

Email Pauline to find out about the many improvements to IRTC since your class. irtc@indauto.com.au.

THE JOYS OF TRAVEL:

If you were to read any IAS positions vacant advertisement, you would find the words "*Overseas Travel Required*". Since IAS' inception in 1981, IAS staff have travelled over 20 million kilometers and visited 40 countries.

Even though this may seem appealing to the avid traveller, there have been numerous instances over the years that have forced our engineers to practice their anti-stress techniques.

There are far too many to relate here, so we will begin with just a few, with more to follow in future Envoy editions.

Ray Davies has many experiences to relate from his travels to exotic locations. He once lost all his laundry in a Chinese hotel and the IAS girls in Australia had to courier him over some new underwear.

Ray and other IAS engineers worked in the Philippines for an extended period. After one night's evening meal, they were very surprised to be presented with a bill for US$700. Our diners handed over all the money they had but were still short. They were permitted to leave but a representative from the host company visited the restaurant the next day to "negotiate".

During that same trip, the guys all boarded a bus to, what they thought was, a particularly good restaurant. Imagine their surprise at being left at the local brothel.

Working in some parts of Russia can also be a challenge (language difficulties; limited credit card facilities; Cyrillic road signs; phone, fax and mobile phone problems). Luckily for Ray he had help in the form of an extremely attractive young guide named Anna. He actually wanted us to feel sorry for him?

More stories will follow...

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