

HotNews

from the heat transfer society

December, 1999



Issue 99/2

President's Night



The President, Tom Mowbray

New twists in heat transfer

For the President's Night in October, Tom Mowbray of Motherwell Bridge Thermal arranged a presentation on the *Helixchanger* which was given by Bert Boxma of ABB Lummus Heat Transfer BV. The meeting was held in the prestigious surroundings of the Royal Academy of Engineering.

Bert showed a video of the flow simulation in a *Helixchanger*. This was followed by a brief history of the shell-and-tube heat exchanger from the first basic designs in the early 1900's to the present day. The first helical-flow type heat exchangers appeared in the 1930's, but it was not until the late seventies that the *Helixchanger* was invented in the Czech Republic. In 1994 ABB Lummus Heat Transfer became the exclusive world-wide licensor for this exchanger.

In suitable applications the *Helixchanger* has many advantages over traditional segmental baffled exchangers, including cost saving on a total life cycle basis, less shell-side fouling, higher shell-side heat transfer, lower shell-side pressure drop, improved flow distribution, and

improved reliability and availability. It offers advantages in applications which are shell-side heat-transfer or pressure-drop controlled, where there is high shell-side fouling, high thermal leakage, or a potential for tube vibration.

Bert described the thermal and mechanical aspects which need to be considered in order to identify the possible use of a *Helixchanger* and presented successful applications of these in the refinery, petro-chemical, power plant, pulp-and-paper and offshore industries

Further information from Bert Boxma, ABB Lummus Heat Transfer BV. Phone +31 70 373 30 91, Fax +31 70 373 31 93.

The UK National

The Sixth UK National Conference on Heat Transfer was held on 15-16 September, 1999. It was a successful event attended by 92 delegates from 10 different countries (counting England, Scotland and Wales as one!).

A very lively format was adopted this time with the authors of the 52 papers being given just five minutes and 3 slides to explain why people should come and see them at the poster sessions. This made the presenters concentrate on telling a good story quickly.

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Membership list

This **HotNews** comes with a full list of **hts** members. If some of your heat transfer colleagues are missing from the list - get them to join now.

This Issue

- The President's night
- The UK National Conference
- Best paper prize
- Forum evenings
- Waste heat!

Forum Evenings

Keep it clean

At the April Forum, Andy Jenkins of NEL posed the question, "Why bother monitoring fouling?" He answered this by emphasising that, if you don't monitor, you cannot control and improve the process. Performance monitoring is already a priority for plant operators, and the future is smart, on-line sensors and advanced process control. Furthermore, the use of fouling monitors does not depend on research progress.

Despite the impression created by the TEMA tables, the fouling resistance is not a constant and hence monitoring is necessary to provide design data and allow control of *real* systems.

Single value data, from a probe or single test section monitor, can be used for real time monitoring and process control, for example, to optimise biocide dosing or on-line cleaning. Parametric study data is more applicable to new plant design or existing plant retrofit and optimisation activities.

In conclusion, fouling monitoring can save money by allowing plant operators to alter conditions to avoid *extreme* conditions enabling optimised cleaning schedules, and providing information for retrofit or new plant design

Running a tight ship

The continued safe operation of many heat exchangers is dependent upon the reliability of their bolted connections. The May presentation by Rod Corbett of Rotabolt Ltd set out to show that this depends on bolt/component quality, joint design and achieving the correct design bolt tension after tightening and *not* on the tightness itself. In particular, there is a direct relationship between failing to attain the *correct* bolt tension and the common failure mechanisms of fatigue, self-loosening and leaks.

The usual methods for tightening, based upon guesswork or rules of thumb, are flogging (often with a spanner and hammer!) and using a torque bar or hydraulic tensioners. Major industries have banned the use of these methods in isolation, unless the required design bolt tension can be guaranteed.

Rod argued that many methods of assuring bolt tension are inaccurate or difficult to apply. This includes electronic strain gauges and ultrasound extension or direct length measurement.

Rod used a demonstration hydraulic bolt tensioner to show how a *Rotabolt* can be tightened several times to the required design bolt load. This illustrated that their system is consistently accurate and easy to use. It has been found to be reliable, compatible with any tightening system, durable, reusable, offers in-service condition monitoring and is cost effective. Rod was able to quote references of successful applications in different industries but particularly in oil refineries and other petro-chemical plants.

Blowing hot or cold

At a lively and well-attended June Forum, Tom Ralston of HTFS of presented the latest release of the air-cooled heat exchanger program ACOL.



Tom Ralston demonstrating ACOL

Never one to duck a challenge (or should I say being foolhardy), Tom went through a full demonstration of ACOL starting by capturing the data from a process simulator, designing the exchanger using the "design envelope approach", refining the design in simulation mode and showing some of the extensive output options. This included, rearranging the 4 passes on screen, examining the graphs of the coefficient variations along each pass and viewing the API specification sheet. Tom went into some detail on the setting plan showing how easy it is to change basic features like whether the bays have shared or separate supports. Just in case you are wondering, the demonstration worked without the traditional, "It sometimes does that, just wait while I re-boot!"

For all the program's fancy features, the accuracy of design depends on having good heat transfer and pressure-drop calculation methods. Tom emphasised that the methods in ACOL are backed by research including the development of a new HTFS model for air-side heat transfer and pressure drop which is much more accurate than the best of the previous methods.

Questions from the audience included practical aspects of how to use ACOL in design like how the air side is specified and how to design to a given tube length. There was the usual complaint from one member that ACOL now has too many nice features so it might be used by a process engineer (horror of horrors

For more details email htfs@software.aeat.com or check out the web site www.software.aeat.com.

Forums - continued

Ups and downs

At the November Forum, Richard Jibb gave an informative talk on reflux condensers, which are a form of non-adiabatic distillation column. Richard is working for his engineering doctorate under the new joint industry/university EngD scheme. In this case the partnership is between UMIST and Cal Gavin.



Richard Jibb

Reflux or knock-back condensers involve an upward flow of vapour with the condensate being allowed to run back under gravity. The particular benefit of this arrangement is that some fractionation can take place as well as the condensation. Hence, the unit operation of heat transfer is combined with that of distillation. This is an energy-efficient process which can often give additional savings by eliminating extra pieces of equipment and associated pipework. A real example was given of a stripper column and conventional condenser above a batch reactor being replaced by a single unit, the reflux condenser. A bonus was that the separation was more efficient thus reducing batch times substantially.

Richard noted that plate-fin exchangers had been used for many years as reflux condensers, and are known as deflegmators. The large surface areas in plate-fin exchangers made them an effective device for this application. However, Richard's objective was to apply conventional shell-and tube exchangers. Using plane tubes, however, was not effective and methods of enhancing the heat and mass transfer were essential. The enhancement devices used were the Cal Gavin wire-wound insets. Experiments and theory showed that these could give the necessary improvements in distillation performance thus making shell and tube exchangers viable as reflux separators.

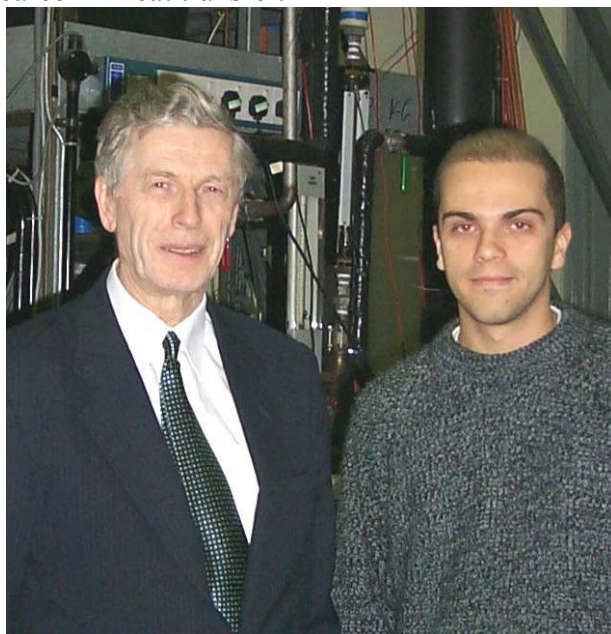
The research underway was two-pronged, using theory to evaluate the consequences of enhancement and experiment to determine the actual amount of mixing and enhancement. Typically, an average size shell and tube exchanger with enhancement is equivalent to about three theoretical plates.

Further information from www.calgavin.co.uk

Best Paper Award

The HTFS prize for the best paper at the 6th UK National Conference on Heat Transfer was awarded to Jader Barbosa and Geoff Hewitt for their paper entitled "A model for forced convective boiling of ternary mixtures".

Jader Barbosa is from Rio de Janeiro where he obtained his BSc and MSc in mechanical engineering before starting his PhD studies in 1997 at Imperial College. Geoff Hewitt, FRS, FREng, was until very recently the Courtaulds Professor of chemical engineering and is now emeritus professor. He has a distinguished career in heat transfer.



Geoff Hewitt and Jader Barbosa

The award committee was particularly impressed that the authors had successfully combined advanced hydrodynamic and multicomponent mass transfer models in an ambitious way to give successful predictions of experimental data. In particular, the paper helps to quantify the reductions in heat transfer when boiling mixtures as compared with boiling pure fluids, an effect of considerable importance in the design of reboilers and other vaporisation equipment

There will be a report on the September Forum on high pressure tube failure in the next edition of *HotNews*

UK national - continued from p1

The downside was that some of the keynote addresses seemed pedestrian by comparison, with their luxury of a 45minute presentation.

As is normal with the UK conference, as distinct from some others around the world, there were many papers of very direct interest to industry. This included papers on promoting dropwise condensation in realistic power condensers, using surface treatments to inhibit fouling in plate exchangers, optimising plate-fin exchangers and the design of high-performance evaporators, to name but a few.

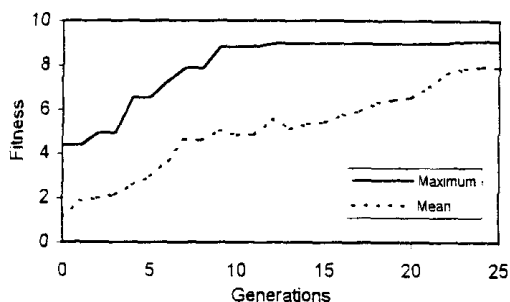
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Waste Heat

by L M Teedy

Cool paper

One of the more interesting papers at the UK National Conference on Heat Transfer concerned the use of *genetic algorithms* to optimise a plate-fin exchanger. The authors simulated a random population of such exchangers and allowed the fittest to mate with each other. Mutations were also introduced to liven things up. After about 20 generations, they could pick out some rather good exchangers. The lead author, and presenter of this paper was Tracy Cool. With a name like that, she should do well in heat transfer. Which reminds me, does anyone know what happened to our good friend Sheldon Tube?



Where were you all?

The Tracy Cool paper was just one of many excellent, innovative and practical papers at the UK Conference. It was sad, therefore, that only about one quarter of the conference delegates were from industry. Clearly times are hard but two days of the year are not too much for heat transfer engineers to find out about the exciting

new research coming out of UK universities and elsewhere.

Remember, you heard it here first

In October, I had to go to the American Petroleum Institute (API) meeting in New Orleans to attend one short session. As I had travelled so far, I thought I should make good use of my time by attending another session on operating experience with shell-and-tube exchangers. I went to the meeting with high hopes of hearing many new stories. However, the meeting comprised two presentations, one by Flexitallic on Kammprofile gaskets and the other by Colin Weil on the consequences of high-pressure tube failure. Both were excellent presentations but they had been the subject of *hts* Forums during the previous few months. This was somewhat disappointing for an old *hts* hand. I just had to go straight from the meeting to Pat O'Briens bar in the French Quarter to drown my sorrows. That's my excuse, anyway.

The views of L M Teedy are not necessarily those of the *hts*.

Regional Forums

The *hts* Committee is currently trying to set up Regional Forums in the North West, the Midlands and the North East. We need the help of somebody in the North East to help us arrange meetings there. Anyone interested should contact the Editor.

Future Events

- London Forum, Thursday, 13 January, 2000
"Integrating thermal and mechanical design"
Tim Griffin, HTFS
- London Forum, Thursday, 10 February,
"What's new in TEMA 98?" George Bowes,
Wellman-Graham
- Annual General Meeting including a short
presentation from LM Teedy, Thursday, 2
March, London
- Annual Dinner, Friday, 31 March, London
- London Forum, Tuesday, 18 April, "Global
warming" John Sandalls, Consultant
- London Forum, Thursday, 18 May, topic to
be confirmed.

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