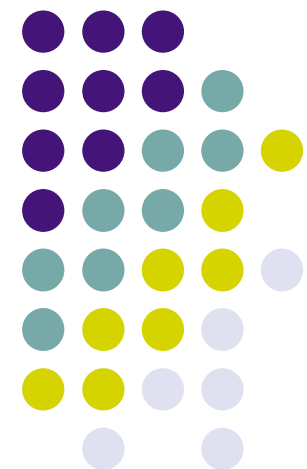
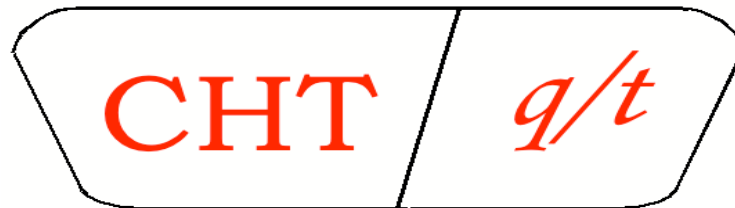
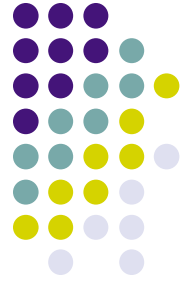


Status of Computer Aided Heat Treatment Planning Systems (CHT-*bf*, -*cf* and -*q/t*)



Kevin Rong and Rick Sisson
Center for Heat Treating Excellence
Worcester Polytechnic Institute

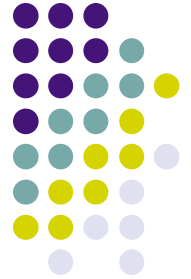




Objective

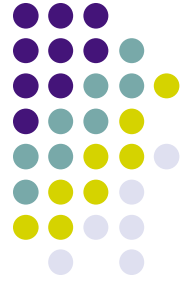
- The goal was to develop an analytical tool to predict the temperature profile of load in batch as well as continuous furnace during heating, quenching and tempering of steel.
- To provide information on the mechanical properties as quenched & tempered
- To optimize the heat treatment process design
- Finally to save energy and reduce cost

Background



- CHT-*bf* was developed and the program was released in 2002.
- CHT-*cf* has been developed and released in May 2004.
- CHT-*q/t* was finished on June 30, 2006
- Maintenance and service was provided until Dec. 2006

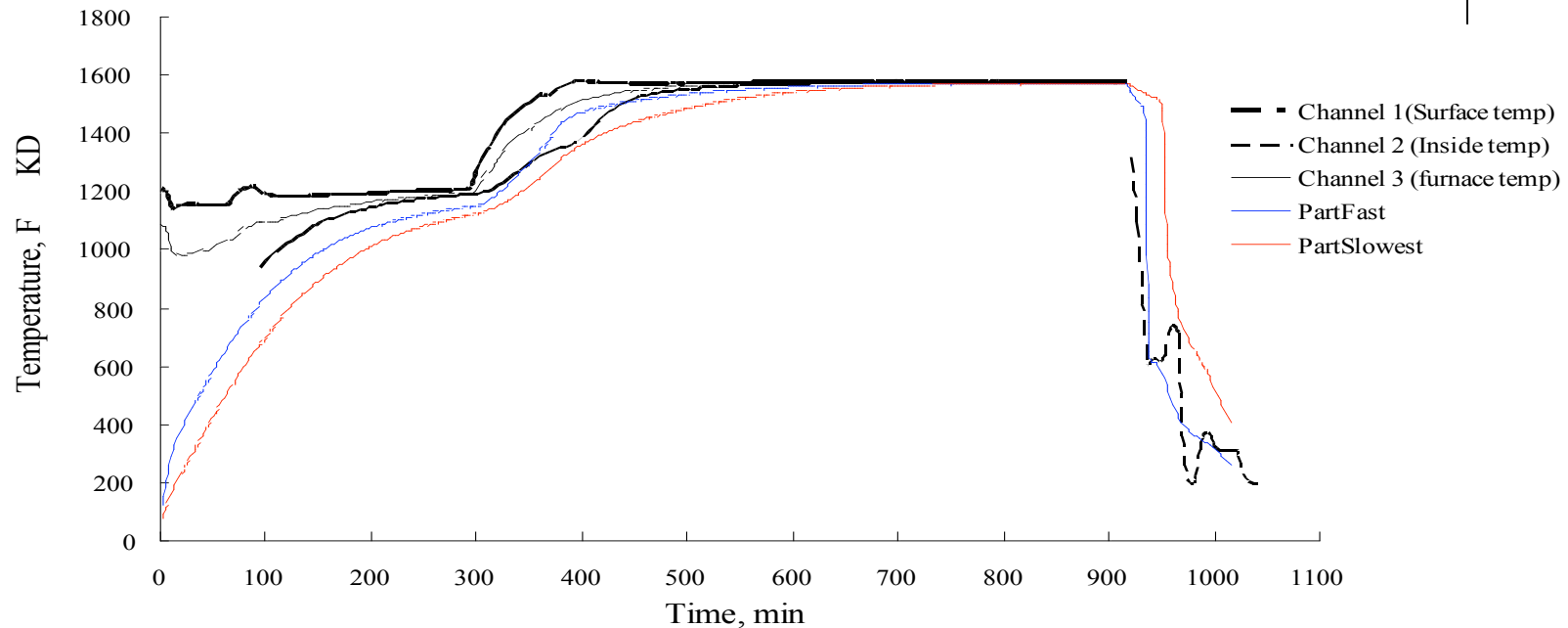
- The software systems have been validated with production data
 - Intensive case studies in Bodycote
 - Current users
 - Caterpillar, Surface Combustion, American Heat Treating, etc.



CHT systems

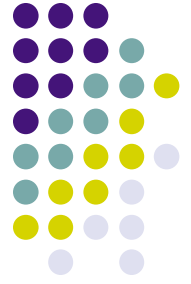
- Thermal analysis of loaded furnaces
 - Furnace model
 - Arranged or random load
- Output temperature profiles of different parts at different locations
 - For batch furnaces: CHT-*bf*
 - For continuous furnaces: CHT-*cf*
- Materials structure evolution and property prediction in quenching and tempering
 - CHT-*q/t* (*bf* and *cf*)

Results



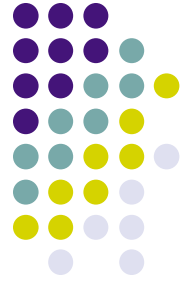
- Prediction results are closed to the measurements, both reach the maximum temperature at the same time.
- The temperature error is within 30F, and the relative error is around 3%.
- During quenching, thermocouple looks like losing contact with part

Commercialization effort - history

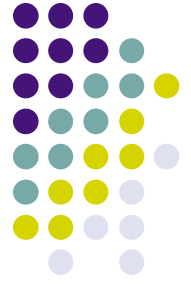


- Air Product proposal in 2005
 - Licensing - no
- ESI in 2006 - no
- NSF STTR Phase I proposal, Dec. 2006
 - JYL Solutions
 - Awarded in May 2007
 - Knowledge acquisition and Web-based service
 - Plan for phase II – need partners?
- Scientific Forming Technologies – DeForm - 2007
 - Potential for commercialization

Scientific Forming Technologies



- April 25, 2007 visit in Columbus
 - Met with Andy Tang, President and John Walters, VP plus technical staff
 - Reviewed CHT capabilities
 - Discussed potential licensing and joint efforts
- June 2007
 - Interested in non-exclusive license and joint efforts
 - Looking for CHTE commercial ideas proposal
 - Are we aligned?



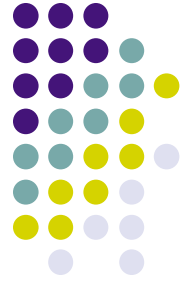
CHTE commercialization ideas

- Make CHT-*bf/cf/qt* available for licensing to major engineering software company
 - Assist in future development of capabilities
 - Assist in marketing?
- Non-exclusive license of CHT-*bf/cf/qt* to SFT to become part of their suite of software capabilities
 - SFT is an excellent fit – DeForm - heat treating software
 - Assist in marketing and support services
- JYL Solutions – SBIR
 - Develop the software for web-based service opportunities
 - Furnace loading design and support
 - Should work in collaboration with SFT?



Next steps with SFT

- Prepare a commercialization ideas proposal
 - June 11, 2007
- Discuss licensing agreement



Future plan

- Best serve to CHTE member companies
- Deal with JYL Solutions and/or SFT
- Future project/development
- Board decision