Thermodynamic Software in Japanese Market

Research Center of Computational Mechanics, Inc.
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Contents of presentation

1. Company outline
2. Japanese market of Thermodynamic Software
3. Application Examples of thermodynamic software in Japan
RCCM location

Tokyo Head Office  Togoshi, 1-7-1, Shinagawa-ku, Tokyo

Osaka Branch Office (Technical R&D and support of Mechanical Finder, FEMS) 4-11-19, Minami-Semba, Chuo-ku, Osaka
Established in 1982  
Capital: ¥60,000,000.- (EUR500,000)  
Annual turnover: ¥1,100,000,000.- (Feb/2009)  
(EUR10mil.)  
Number of employees: 72

Sales Category in 2009

- Software sales: 49%
- Calculation and analysis: 29%
- Software development: 13%
- Consulting: 8%
Transition of RCCM business

1st Period (1982-1986): Development of structural analysis program

2nd Period (1987-1991): Overseas Techniques are introduced (Computational Fluid Dynamics)

3rd Period (1992-1996): Development of RCCM own brand program


5th Period (2002-now): Further development of consulting business
Main Customers

- Japan Atomic Energy Agency
- The High Pressure Gas Safety Institute of Japan
- Central Research Institute of Electric Power Industry
- Tokyo Electric Power Corporation
- Kajima Corporation
- Ube Industries
- Sumitomo Osaka Cement Co., Ltd.
- Sony Corporation
- Hitachi Ltd.
- Panasonic Corporation
- Nippon Steel Corporation
- Mitsubishi Heavy Industries Ltd.
- Nissan Motor Co., Ltd.
- Bridgestone Corporation
- Canon Inc
Products(1)

Structure, Mechanism

SAMCEF
MECANO
NX Nastran
IR-FEM

Compressible Analysis of Rubber Material (NX Nastran)

Airplane Flap Analysis (MECANO)
Products(2)

Computational Fluid Dynamics

AnsysFluent (calculation & analysis)
AnsysPolyflow (calculation & analysis)
Moldflow
VorCat

Moldflow Example (Mold Warp)

Polyflow Example (Blow Molding)
Products(3)

Thermal & Welding Analysis

Quick-Therm
Quick-Welder
Quick Spot
(Red letters: RCCM own brand products)

Quick-Spot Example

Quick-Welder Example
Civil Engineering, Construction

ASTEA-MACS
ENGAI
ASTEA-LEAKAGE
RC-POST
ATENA

Underground Water, Environmental Contamination
ASTEA-SEAPAGE
Medical

Mechanical Finder (Bone Strength)
FEMS (Functional Effective Muscle Strength)

Mechanical Finder Example

FEMS Example
Products(6)

Thermodynamics

FactSage
ChemApp
ChemSheet
KilnSimu

FactSage Example
(SiO₂-CaO-Al₂O₃)

KilnSimu Example
(Cement Process)
Mesh generation software

Ansys ICEM CFD

ICEM CFD
Various Meshes
Products(8)

Fluid Acoustics, Vibro Acoustics

ACTRAN/VA
ACTRAN/TM
ACTRAN/AA

Actran/TM Projector Analysis
Japanese Market of Thermodynamic Software

Exclusive distributor of GTT products in Japan

Start selling in 2001

- Steelmaking
- Non-ferrous metals refining
- Cement
- Chemical Industry
- Waste Treatment
- Nuclear Power
- Others

The number of FactSage user licenses

0 20 40 60 80 100 120 140
Japanese Market - Customer relationship

Software sales & support, Consulting Analysis system development
Japanese Market

• What RCCM has done for Japanese market

1. FactSage Manual in Japanese → Translate all ppt slides into Japanese + add many calculation examples → complete as tutorial guidebook

2. Training Course
   FactSage basic training: 6 times a year
   FactSage advanced training: 6 times a year
   Generation of thermodynamic data: 4 times a year
   ChemSheet: 3 times a year
   ChemApp: 4 times a year
Japanese Market

• What RCCM has done for Japanese Market

3. Customer Support On-line in RCCM web page
   - FAQ
   - Calculation examples
   - Operation examples

4. Tokyo Workshop (FactSage yearly userconference)
   - Introduction of FactSage new version
   - User presentations
   - Hands-on seminar
FactSage support online

Products

Training & Events

Support online
FactSage support online

1. Click Support

2. Enter username and password

FactSage online support
FactSage support online

Frequently asked questions

Download Documents
KilnSimu: Simulation of multiphase chemistry in counter current or co current rotary kilns

11 customers
  - Cement process(1)
  - Thermal treatment of wastes(3)
  - Ni ore refining(2)
  - WAELZ (production of ZnO, Zn)(2)
  - Others(3)
ChemSheet: EXCEL add-in for thermochemical process simulation

6 customers
- Copper Sulfide Flash Smelting
- Solid-Oxide Fuel Cell Process
**ChemApp, Application examples (Japan)**

**ChemApp**: thermochemistry library for your software

- Cement Kiln / ChemApp + Pro/II(Process Simulator)

- Halogen lamp/ChemApp+FLUENT(Computational Fluid Dynamics)
ChemApp + FLUENT
Purpose

Simulation of chemical species concentration change in thermo-fluid using commercial programs

Halogen lamp

Partial pressure of Tungsten oxide at a point

\[ p(\text{WO}_x) \]

Time

Graph showing the change in partial pressure of Tungsten oxide with time.
Commercial programs

**ANSYS FLUENT**

- Most famous flow modeling program in Japan
- Good models of thermo-fluid systems for industrial applications
- Solve user defined scalar (chemical species concentration) transport equation in flows

**ChemApp**

Rich set of subroutines for the calculation of complex multi-component, multiphase chemical equilibria
Scalar transport equation

Mass Concentration Equation in Fluid

\[
\frac{\partial \rho Y_i}{\partial t} + \frac{\partial}{\partial x_k} \left( \rho u_k Y_i - \rho D_{im} \frac{\partial Y_i}{\partial x_k} \right) = w_i
\]

- \( Y_i \): the mass concentration for species \( i \)
- \( D_{im} \): coefficient of molecular diffusion for mixture \( m \)
- \( w_i \): mass production per unit time and mass

FLUENT solves the scalar transport equation:
FLUENT calls user-defined program with ChemApp.

**Diagram:**
- **Initialization** → **Begin time loop** → **Calculate equilibrium (call ChemApp)**
- **Repeat**
  - **Solve velocity and mass concentration**
  - **Check convergence**
- **Update properties**
- **Exit loop**
Conclusion

FLUENT linked to ChemApp is utilized in the simulation for time change of chemical species concentration.
Thank you for your attention!