What's New in I-deas12: TMG & ESC Digital Simulation Solver Update

Remi Duquette
MAYA Heat Transfer Technologies
remi.duquette@mayahtt.com
1.800.343.6292

Pete Ogilvie
UGS
pogilvie@ugs.com

TMG: Monte Carlo Technology

- Alternate method to compute view factors, radiative conductances, and environmental heat loads
- Provides capability to compute environmental and radiative heat loads directly, bypassing Oppenheim's (radiosity) and Gebhardt's methods
- Allows for the simulation of interaction of radiation with participating media, i.e., absorption and scattering of light through a semi-transparent solid
- Permits simulation of advanced optical properties
  - Direction-dependent emissivity
  - Bidirectional reflectance distribution functions (BRDF)
- Fully compatible with other TMG radiation analysis methods

TMG: Monte Carlo Options Overview

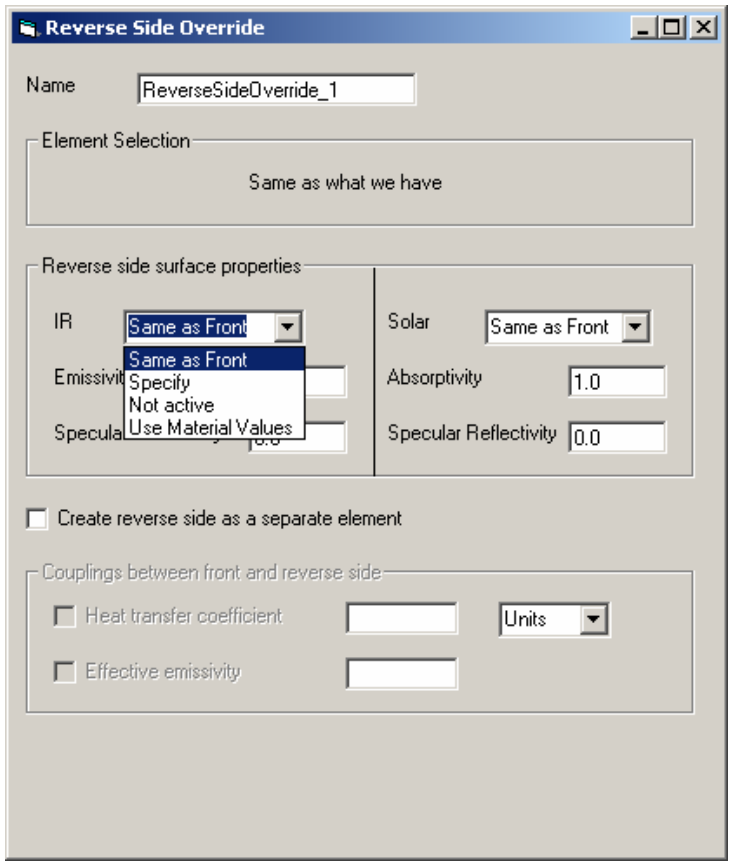
- **View Factors**
  - **“Blackbody” view factors**
  - **Earth View Factors**
  - **Solar View Factors**
  - **Albedo View Factors**
  - **Heat Flux View Factors**
- **Radiative Couplings**
  - **Option to calculate RAD’s directly with MC technique**
- **Heat Loads**
  - **Option to calculate HTF’s directly from radiative sources, earth, solar, or albedo**

TMG: Temperature Mapping Enhancements

- **A new forms-based user interface for Temperature Mapping has been developed:**
  - Select TMG run directory
  - Specify output types, files
  - Selection of time points to be mapped
  - Assignment of SID labels to time points
  - Option to split output into multiple files, by SID
  - Multiplication factor for transverse gradients
- **To run the new UI manually:**
  - File | Program Files | Run | SDRC_TMGIF:tempmap.prg
- **To set the new UI as the default for all users:**
  - cd .../tmg/if
  - mv -f int_run.prg int_run.prg.orig
  - cp tempmap.prg int_run.prg
- **Axi-symmetric models can be mapped to 3D structural models**

TMG: Enhancements for Modeling MLI

- Thermal Couplings on Reverse Sides form
  - Creates conductances between front and reverse sides
  - Can specify heat transfer coefficient or e*
- New Thermal Coupling option
  - Allows you to create a Radiative Thermal Coupling by specifying a ScriptF value instead of a gray body view factor



TMG: View Factor Culling

- **New method based on maximum view factor contribution to be removed.**
  - Calculate all view factors for element i
  - Sort in ascending order
  - Remove first *n* view factors from list such that

$$\sum_{i=1,n} VF_{in} < C$$

  - Only available with hemicube method
  - Can be set through the Advanced Solver Options

TMG: General Enhancements

- **Linux Port**
  - TMG has been ported to Linux (SUSE Linux Enterprise 9)
  - I-DEAS TMG users will be able to exploit dual-licensing with NX in order to run batch solves on Linux

- **I-DEAS Section Support**
  - Geometry-based BC’s for TMG can now be applied on sections
  - Sections are placed in a group, which is then selected on the TMG entity; elements associated with the section are associated with the entity at solve time

TMG: General Enhancements

- **TMG solver now uses double-precision for temperatures**
  - **Enables extremely precise computation of heat flows**
- **Improved handling of ablative models**
  - **Phase change supported with multilayer shells, solid and axi-symmetric elements**
  - **Increased solution robustness**
  - **Accommodates char material**
- **Improved accuracy for treatment of specular reflections and transmission**
  - **Anti-aliasing algorithm**
- **Temperature BC's (SINK) can be specified from a file in TEMPF format**

TMG: General Enhancements

- Proportional, PID Heater Control
  - Thermostat entities can be defined to model proportional or PID controller
  - Not yet supported in I-DEAS UI
- New Results Data
  - Minimum/Maximum temperatures for each element over a transient solve
  - Element phase change quality
- Capability to use a steady-state solve to initialize a transient
  - TINIT STEADYSTATE GRADNT DTP DT TST TF
  - Not yet supported in I-DEAS UI

ESC: Non-newtonian Fluids

- Activated via a generic entity
- Three physical models supported
  - Power law (molten polystyrene, polymers)
  - Herschel-Bulkley and Bigham for viscoplastic fluids:
    - Blood, drilling mud, nuclear fuel slurry, mayonnaise and toothpaste.

ESC: Supersonic Flow

- Viscous heating effects now taken into account in the energy equations.
- Thermal wall functions modified to account for viscous heating using recovery / adiabatic wall temperatures.
- Transient pressure terms added to energy equations: improves accuracy and robustness of high speed flow solutions.
- Additional terms accounted for in energy equation for rotating flows (RFR) at high speed.
- Flow solutions up to Mach 4 now supported
- New Supersonic Inlet entity: specify Mach number, flow direction, and other inlet conditions

ESC: General CFD Enhancements

- Parabolic elements
- Time varying pressure and temperature BC’s on vents added to the user interface
- Option added to Surface Properties dialog to trigger natural convection wall function. Can be applied locally on selected surfaces.

Any Questions?

Presented by MAYA Heat Transfer Technologies Ltd.

www.mayahtt.com : info@mayahtt.com : 1-800-343-6292