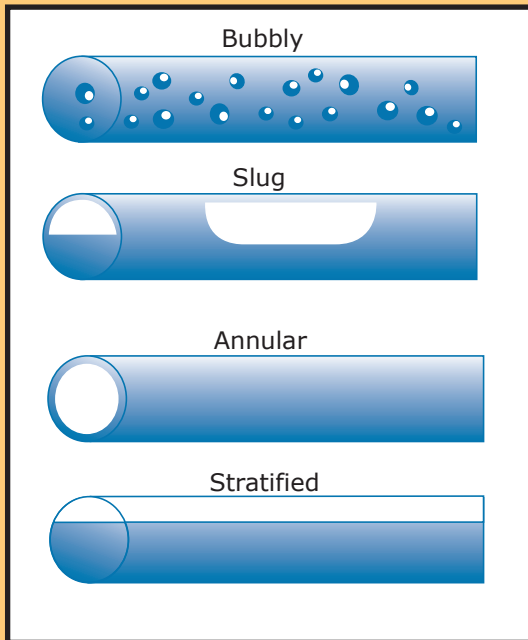


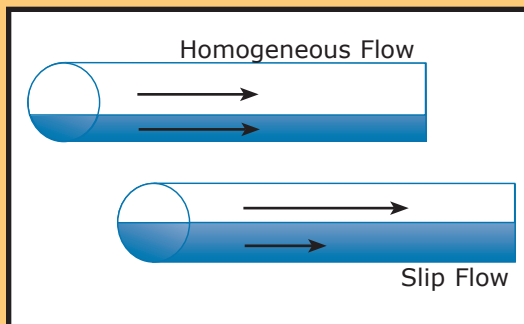
TWO-PHASE FLOW ANALYSIS

THE MOST COMPREHENSIVE TWO-PHASE

THERMOHYDRAULIC ANALYZER AVAILABLE



Flow Regime Mapping



Slip Flow, Nonequilibrium Flow, Mixtures, Dissolution...

C&R TECHNOLOGIES' FLUINT, the flow analyzer in SINDA/FLUINT, was designed right from the start to handle the peculiarities of two-phase flows. In fact, its development was initiated specifically to avoid the shortcomings of single-phase analyzers that had been retrofitted to adapt to two-phase problems.

Combined with the heat transfer capabilities of SINDA, the sketchpad interface of Sinaps®, the CAD-based interface of FloCAD® (a module of Thermal Desktop®), and the unique capabilities such as parametric analyses, optimization, calibration, and statistical design, SINDA/FLUINT is truly in a class by itself.

TWO-PHASE FLOW CAPABILITIES

- Complete thermodynamics: phases appear and disappear as conditions warrant
- Two-phase heat transfer correlations built-in or user-defined
- Two-phase pressure drop correlations built-in or user-defined
- Automatic flow regime mapping
- From quasi-steady homogeneous equilibrium to fully transient two-fluid modeling
- Optional slip flow modeling (separate phasic momentum equations)
- Optional nonequilibrium transients (separate phasic energy and mass equations)
- Capillary modeling tools for static or vaporizing wicks
- Optional tracking of liquid/vapor interfaces

TWO-PHASE MIXTURE CAPABILITIES

- Mixtures of up to 26 liquids and/or gases
- Optional condensable/volatile component in mixture, including effects such as diffusion-limited condensation
- Optional dissolution of any number of gaseous solutes into any number of liquid solvents, including homogeneous nucleation models

TWO-PHASE FLOW ANALYSIS

THE MOST COMPREHENSIVE TWO-PHASE

THERMOHYDRAULIC ANALYZER AVAILABLE

SAMPLE INDUSTRIES

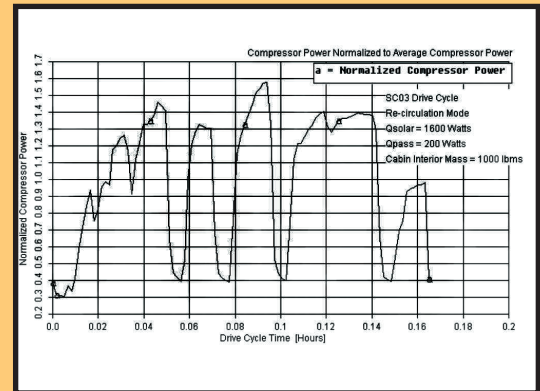
- Automotive (climate control, transmissions, fuel/air)
- Electronics (two-phase cooling, condensation)
- Aerospace (thermal management, propulsion, ECLSS)
- Aircraft (air conditioning, fuel/air)
- Energy Systems (BWR, Rankine cycle power plants)
- Petrochemical and Pharmaceutical (gas transport, steam injection, two-phase processes)
- Fire Safety (liquid retardant delivery)

SAMPLE APPLICATIONS

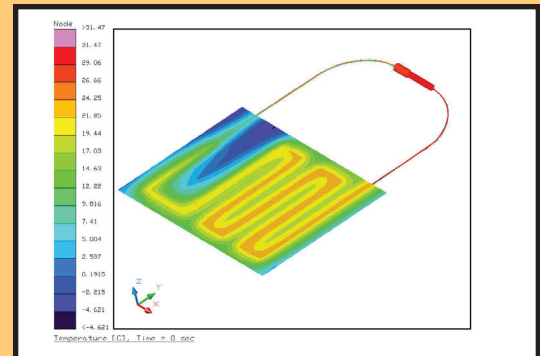
- Condenser, evaporator, and boiler sizing and simulation
- Vapor compression and Rankine cycle analyses, including dynamic responses
- Throttling processes, including Joule-Thompson cooling with two-phase outlets
- Loop heat pipe (LHP) and capillary pumped loop (CPL) design and simulation
- Two-phase thermosyphon simulation
- Integrated analysis of liquid propulsion systems and cryogenic dewars, including fuel and oxidizer tanks, feed lines, thermodynamic vents and vapor-cooled shields, pogo suppression systems, anti-geyser lines, pressurant systems, line filling, thermally stratified tanks, and turbomachinery cool-down
- Gas storage and distribution systems including the effects of condensation
- Fuel/air systems
- Waterhammer and other fast transient effects including flashing, column separation, chugging and other oscillations in two-phase lines
- Pressurized fire retardant delivery systems
- Condensing air heat exchangers and wet air psychrometrics, including condensation on electronics
- Fuel cells and support equipment

CUSTOMIZATION AND CONSULTING

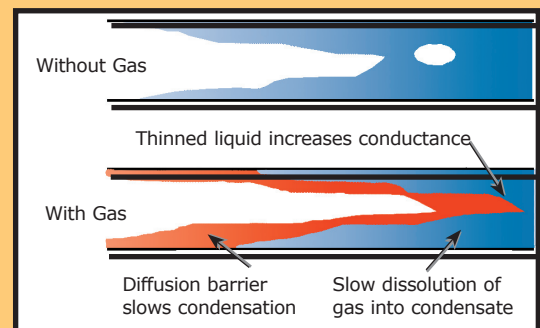
C&R provides consulting and custom software solutions, including the specialized field of two-phase systems.



Vapor Compression Cycle Dynamics



Loop Heat Pipe Design and Analysis



*Complex Phenomena Example:
Condensing in the Presence of
Noncondensable Gases*

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