



INDUSOFT DATA RECONCILIATION INFORMATION MANAGEMENT SYSTEM (I-DRMS)

KEY SOLVER FEATURES:

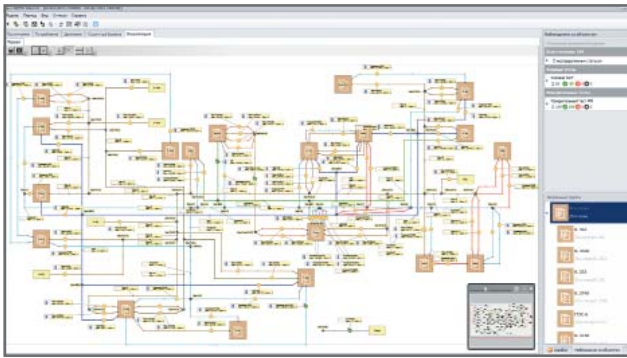
- **Fastest-in-class data reconciliation algorithm**
Data reconciliation for a big refinery (more than 5,000 entities such as units, tanks and flows) takes 2 seconds.
- **Fast and universal algorithm for detecting all types of gross error**
I-DRMS uses a fast procedure to carry out all the standard statistical tests in one run. This can be used to detect all possible cross-flows, leaks and gross errors. For a big refinery, this procedure takes 20 sec to perform 12.5 million statistical tests, including all possible inter nodal tests (INTs), nodal tests (NTs) and measurement tests (MTs).
- **Complete analysis of sensor network**
I-DRMS uses a special explicit formula to:
 1. Classify measured balance variables into two classes: redundant (R) and non-redundant (NR)
 2. Classify unmeasured balance variables into two classes: solvable (S) and non-solvable (NS)
 3. Evaluate the uncertainties of the balanced variables
 4. Evaluate the effect of sensor accuracy on balance uncertainties..
- **Fast and robust component balance reconciliation using a linear approach**
A component balance is especially needed for ore-processing plants. Usually a component balance is considered to be a bilinear problem that can be resolved by an iterative procedure. This results in the following drawbacks:

- Production and energy accounting
- Gross errors and loss detection
- Metering system analysis
- Material movement management

- Reconciliation takes rather a long time because each iteration is a complete data reconciliation problem.
- There is no guarantee that the iteration procedure will converge because there are no proofs of convergence of the procedure.
- It is not possible to use advanced methods of analysis of measurement systems. All such methods are designed for linear systems (see above).

I-DRMS solver makes use of a special change of variables to make the problem linear. This allows us to overcome all the above drawbacks.

- **Ability to receive integer-valued balance**
Usually accounting systems round off the reconciled numbers in reports. This spoils the reports because rounded numbers destroy the balance. I-DRMS solver uses a special integer-valued data reconciliation procedure to overcome this problem. It returns integer reconciled values of variables (e.g. integer kilograms) that are not rounded by accounting systems.



Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
2012	280.287	281.236	0.957	0.000	280.287	280.287	0.000	0.000	0.000
2013	280.287	281.236	0.957	0.000	280.287	280.287	0.000	0.000	0.000
2014	280.287	281.236	0.957	0.000	280.287	280.287	0.000	0.000	0.000

More than 30 installations in oil and gas, chemicals, metals and mining, water treatment and distribution industries

Analysis of the statistics for the corrections allows such shifts and leaks to be detected after sufficient time. I-DRMS provides its users with advanced tool for such analysis.

Balance reconciliation within technological and metrological constraints

Sometimes the reconciled values violate metrological or technological restrictions. For example, a reconciliation correction may exceed the tolerance of a sensor or a reconciled value may appear to be negative. In such a case, the report may be rejected by metrologists or accountants. To resolve this problem, I-DRMS has an option to find reconciled values inside the “box” of metrological or technological restrictions.

I-DRMS allows a user to adjust reconciliation results according to any additional requirements
Often a user has additional requirements, such as not correcting some measurements, maintaining a ratio between some flows, etc. I-DRMS solver analyzes these requirements and satisfies them when they are feasible.

Identification of minor measurement shifts and losses that cannot be detected after one reconciliation

Minor errors and losses cannot be detected by standard statistical tests using only one balance period. However, persistent leaks and small shifts in measurements leave their traces in corrections made by data reconciliation

Data reconciliation for toll processing and product allocation

I-DRMS solver has an option to combine data reconciliation with toll processing and product allocation. Unlike standard data reconciliation, this option not only keeps mass balance restrictions but also takes into account the desirable ratio between materials belonging to various owners and originating from various sources. This procedure is based on mutual projection between the area of obligatory restrictions (balance, metrological and technological) and the subspace of desirable ratios.

KEY INTERFACE FEATURES

- **Handy interfaces:**
 - Spreadsheet interfaces throughout the whole model, providing a drill-down ability.
 - Graphical interface, giving a visual display of the flows of raw materials and products.
 - Modeling interface, allowing a user to create all the model objects (units, tanks, nodes, flows and sensors).
 - Interface for analysis and retrofit of sensor network.
 - Interface for detection of gross errors and leaks.
- Flexible tuning of the interfaces for every user, user group and business process.
- Effective collaboration by multiple users.
- Simultaneously work with multiple models.
- Tools for reporting, standard and customized.
- Easy localization tools