Developing and maintaining Swiss Re’s Internal Risk Model ICAM in MATLAB

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Key Takeaways

1. Swiss Re has developed a professional enterprise application with MATLAB
2. MATLAB and Swiss Re’s internal risk model ICAM have been growing over the last decade
3. Measurable outcome: transparency, flexibility, maintainability
Swiss Re is the world’s second largest reinsurer
- Founded in 1863, head quarters based in Zurich with offices in 25+ countries and 14’000+ employees
- Shareholders’ equity 2016: USD 35.6bn
- Net premiums/fees earned 2016: USD 33.2bn
- CO₂ programme (2013-2020 Greenhouse Neutral Programme)
- Launch of Swiss Re Institute in 2017 (http://institute.swissre.com)
Swiss Re’s Internal Risk Model ICAM (internal capital adequacy model)

• Long history of using an internal risk model to steer the company and for regulatory purposes: Swiss Solvency Test (SST) and Solvency II

• For a decade, Swiss Re has used MATLAB to implement its internal risk model ICAM

• ICAM is developed/maintained by Risk Modelling, a team of 13 people with a broad range of educational backgrounds
Swiss Re’s Internal Risk Model ICAM (internal capital adequacy model)

- In 2017, Swiss Re concluded a major project called **IRAMP** (integrated risk analytics & modelling platform) to overhaul ICAM with key goals
  - transparency
  - flexibility for future developments, maintainability
  - speed
  - precision of risk measures (expected shortfall, value at risk, etc.)
Many different approaches to present ICAM...

Mathematical/actuarial/algorithmic approach

IT/technical approach

Economic/risk management approach

Educational/training approach
Many different approaches to present ICAM...

“MATLAB approach” – why and how are we using MATLAB?

• All-in-one solution: parallel computing, data import/export, profiler, debugger, unit testing framework, GUIs, algorithm collection, speed, etc.

• Flexibility for Risk Modellers

• KISS principle (keep it safe, simple, smart, etc.)

• MathWorks is a strong partner to avoid FOMO (fear of missing out) while current tools landscape is growing too fast to follow
System Architecture

- Model development in development (and training) environment, 160 workers on MDCS, use of Parallel Computing Toolbox, 30+ users working directly with MATLAB.

- Generation of risk reports in production environment, 224 workers on MDCS, risk reports essentially are consumed by the whole company as well as external stakeholders, e.g. regulators, auditors, rating agencies, etc.
An integrated risk model is needed to understand the aggregate joint impact of all risk factors on the total economic balance sheet.
ICAM Demo (running on modified/artificial data)

- ICAM main user interface
- Legal entity network
- Data visualization
- Export/modify/import functionality for all objects
- Well-defined objects (risk factors, loss functions, loss transformations, etc.) keeping track of all dependencies
- Master data hierarchies
- Contributions to shortfall

Legal entity network:
- Well-defined objects (risk factors, loss functions, loss transformations, etc.)
  - keeping track of all dependencies
ICAM Demo (running on modified/artificial data)

Risk System monitor

Validation rules run on data classes

All data classes and tasks have an owner/deputy, description, version

Data classes (simple tables)

Keeping track of all data flows

Tasks (transformations, filters, models, pre-processing, etc.)
ICAM Demo (running on modified/artificial data)
ICAM in Numbers

- More than 400 data classes (tables) with about 4’000 data attributes (columns) in total
- About 50 tasks (transformations, pre-processing, etc.)
- About 250 classes for risk factors, loss functions, etc. in ICAM
- Currently about 150 data validation rules – number still growing
- About 400 unit tests
- About 70’000 lines of code
- About 15 user interfaces for risk exploration, as-if calculations, education, etc.
Conclusion and Summary

• Swiss Re has developed a professional enterprise application with MATLAB
  • the key goals transparency, flexibility, maintainability were achieved by making extensive use of what MATLAB offers, e.g. graphical user interfaces, object-oriented programming, unit tests, data exploration tools, profiler, debugger, etc.

• Forward-looking plans
  • further model development
  • internal (and external) trainings
  • explore potential cloud migration

MATLAB is an excellent all-in-one solution for developing and maintaining Swiss Re’s complex internal risk model ICAM.
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