

Reactor noise analysis as a practical tool in NPPs

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Opportunities and new enablers for RNA applications (examples)

Opportunities for RNA: there is a need in NPPs for

- automated online condition monitoring,
- signal validation,
- non-intrusive fault detection,
- parameter estimation, ...

that can support decision-making related to O&M, safety and licence requirements.

Opportunities and new enablers for RNA applications (examples)

New enablers of RNA: availability of new advanced applications in

- digital data collection of existing station signals (high resolution, large number of signals, synchronized,
- digital processing of large amount of measurement data (online, real-time),
- SW applications modelling system dynamics for interpreting or predicting RNA findings,
- new ways of visualization, ...

Opportunities and new enablers for RNA applications (examples)

- Possibilities of adding AI as a supporting tool to interpreting/categorizing noise signatures, solving inverse problems, identifying patterns.
- Technical possibilities of fleet-wide large-scale RNA-based monitoring with focused and standardized applications – especially for SMR fleets

What RNA can offer (example):

- Diagnostics of pressure sensing lines for the purpose of anomaly detection, such as identifying instrument lines with leak or blockage
- In-situ response time estimation flow/pressure TX
- Flow anomaly investigation in the time and frequency domains
- Diagnostics and fault detection in local power control system and instrumented fuel channels
- Response time estimation and signal validation of RTDs
- Monitoring moderator flow by RTDs and SPNDs
- Monitoring flow-induced vibration of fuel channels and detector tubes
- Estimating promptness of SPNDs

What RNA can offer (under development):

- Automated signal validation and incipient failure detection
- Estimating global feedback parameters online: MTC of reactivity
- Detecting coolant boiling at outlet of high-power fuel channels

What would it take to make RNA a practical tool?

- As a non-standard technique, RNA can be successfully used in NPPs only if management is convinced about its usefulness
- RNA has to demonstrate business benefits and its usefulness in meeting regulatory requirements – ROI, sustainability
- Best case: RNA can provide solutions for operational problems or required by the nuclear regulator

What would it take to make RNA a practical tool?

- RNA needs to have access to high-quality measurement data (time length, steady-state operation)
- NPPs may want to see results in a timely manner – large amount of data to be processed real time or online
- RNA-team needs to develop analytical or data-driven models of the given applications for interpreting spectral results
- NPPs need in-house expertise being “smart buyers” for external RNA services

Thank you!

