Framework of Reactor Noise Analysis
Benchmark Tests for SMORN III
Japanese Preparatory Committee of SMORN-III

1. Objectives

Identical source data of reactor noise will be distributed to the participants who will analyze them by the methods which they consider most appropriate. The results, together with the man- and the machine-workloads, are to be compared for different methods and conditions of the analysis, e.g. analog vs. digital; sampling interval, accuracy of quantization (digital analysis); time domain vs. frequency domain; Blackman-Tukey type vs. AR/ARMA model fitting; pre-processing modes; filter characteristics; window characteristics; and computer programs.

It is expected that these tests will provide materials for (1) comparison of noise analysis results published by authors from different institutes, (2) establishment of reactor noise data banks, and (3) libraries of reactor noise analysis computer codes.

The source data will consist of the artificially synthesized noise and the real reactor noise. The purpose of including synthesized noise is to confirm that the results by different participants will agree for "clean" noise free of nonlinear and/or nonstationary effects, which may be more or less inevitable in the real reactor noise.

2. Schedule

The source noise data for the tests and the reporting format will be sent to the applicants in January 1981. They will be requested to send their results to the Japanese Organising Committee at least six weeks before SMORN-III in order to make it possible for a reporter to summarize the results at the meeting.

3. Test Data

A. Artificial Noise

A simplified boiling water reactor model is built on hybrid computer. Independent artificial noise signals from noise generator are fed to the model at a few points. Some of the selected system variables are recorded on magnetic tape as follows:
Synthesized BWR-like Noise Data

Model:  JPDR-II linearized model with transport delay $e^{-0.248S}$

Computer:  EAI PACER 680 Hybrid Computer System

Recorded Tape  Scotch 780, 1"x 3600 feet

(1) Play back speed: 1-7/8"/sec.

(2) Contents:

(I) Test signals: 10 Hz, 100 Hz, 1 KHz, 20V p-p

3 min.

(II) Noise signals: 3 hrs.

Channel 1: Void Volume in Core
2: Heat Flux per Unit Length
3: Inlet Water Velocity
4: Location of Boiling Boundary
5: Vessel Pressure
6: Inlet Water Enthalpy
7: Recirculation Flow
8: Neutron Density
9: Noise Source $f_a$
10: Noise Source $f_b$

Note: Noise signals are adjusted so that they have the same order of standard deviation.

B. Real Reactor Noise

Drs. J. B. Dragt and E. Turkcan, ECN, Petten have provided a 3 hrs recording of measurements of the Borssele reactor (PWR). It consists of 6 ex-core, 6 in-core neutron detector noise signals and two-primary pressure noise signals as well as the calibration signals at the beginning of the tape.

Data Format

The noise data will be recorded in a FM analog form on 1"-wide 14-channel tape in 10-1/2"-reel (3600'-long). The recording speed of 1-7/8 ips is proposed tentatively. The recording equipment will be AMPEX PR 2200. For playback, the same type of machine is desirable, but in principle any tape-recorder that fits the Intersrange Instrumentation Group (IRIG) standard may be compatible.

Besides the source noise data, sine waves of fixed amplitude and frequency will be recorded for calibration purposes. Main characteristics of the recording equipment and the input sensitivity of the recording will be provided with the tape.

The digital data sampled from the above mentioned analog data may be available from the NEA Data Bank.
5. **Information on Test Data**

The variable name and its scale of recording will be identified for each channel of the tape when the tape is sent to the applicants.

As to the artificial noise, the simulated reactor model structure will be made known, but not the individual model parameters. As to the real reactor noise, important design and operational parameters of the reactor will be made known.

6. **Tasks To Be Reported**

**Standard**

PSDs, CFs, CHFs and others for a specified pair of variables should be obtained and reported in graphical form.

**Optional**
The system model of the reactor (AR/ARMA, TF, etc) and other findings of the analysis are to be reported as optional.

7. **Application**

Application for the benchmark test will be accepted by receiving the attached APPLICATION FORM before the end of December 1980.
SMORN-III Benchmark Test
APPLICATION FORM

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<thead>
<tr>
<th>Applicant's name</th>
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<tbody>
<tr>
<td>Organization</td>
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<td>Mailing address</td>
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<tr>
<td>Type of analog data recorder available for your noise analysis</td>
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<td>Method of analysis (digital, analog or hybrid?)</td>
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<td>Other notes if any.</td>
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If you wish to apply for the benchmark test, you are requested to fill this application form and send it to:

Dr. J. Hirota
Japan Atomic Energy Research Institute
Tokai, Ibaraki, 319-11, JAPAN