# VIBRATION CORNER

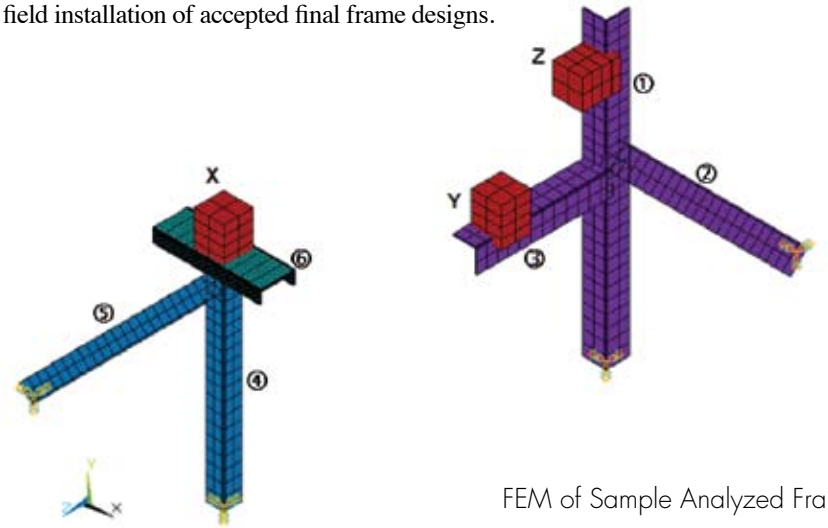
*By: MIROSLAV TRUBELJA*
mtrubelja@structint.com

## MODAL ANALYSIS OF LANYARD POTENTIOMETER SUPPORT FRAMES

The preoperational and startup testing for a new Advanced Boiling Water Reactor, (ABWR) plant will use lanyard potentiometers (LP) to monitor thermal movements as well as displacements due to vibration. The LPs will be mounted on steel frames in 3 orthogonal directions. The frequency range of interest for the measurements is up to 20 Hz and stiff mounting frames are required for correct results.

Acceptability of the frames is determined through modal analysis. Modal analysis produces the frequencies and mode shapes that characterize the response of a structure to dynamic excitation. The mode shapes and frequencies are characteristics of the configuration, stiffness and mass of the structure. The first modal frequency of a structure or component is often used to determine flexibility or rigidity. In most seismic analysis, rigid structures and components have frequencies of at least 33 Hz and the non-seismic loads (e.g., SRV actuation) have a cut-off frequency of 60 Hz, for example. Since the pipe frequency is expected to be in the 1-20 Hz range, a stiffer LP support system is desired, with first natural frequencies between 80 and 100 Hz.

Structural Integrity performed the modal analysis of proposed frame designs using finite element modeling (see illustration), improved upon the original design and will participate in field installation of accepted final frame designs.




FEM of Sample Analyzed Frame

## STRAIN GAGE DATA COLLECTION FOR MUR POWER ASCENSION

In the fall of 2010, we supported a US nuclear power plant with the acquisition of vibration data during implementation of measurement uncertainty recapture (MUR). MUR is a type of power up-rate that typically increases reactor power by up to 2%. MUR is achieved by implementing advanced techniques for determining reactor power, including the addition of highly accurate flow meters in the feedwater line, whose readings are used to calculate reactor power. Specifically, Structural Integrity used its previously installed 32-channel strain gage data acquisition system which collected vibration data related to pressure pulsations in main steam lines. The data was collected throughout power ascension to

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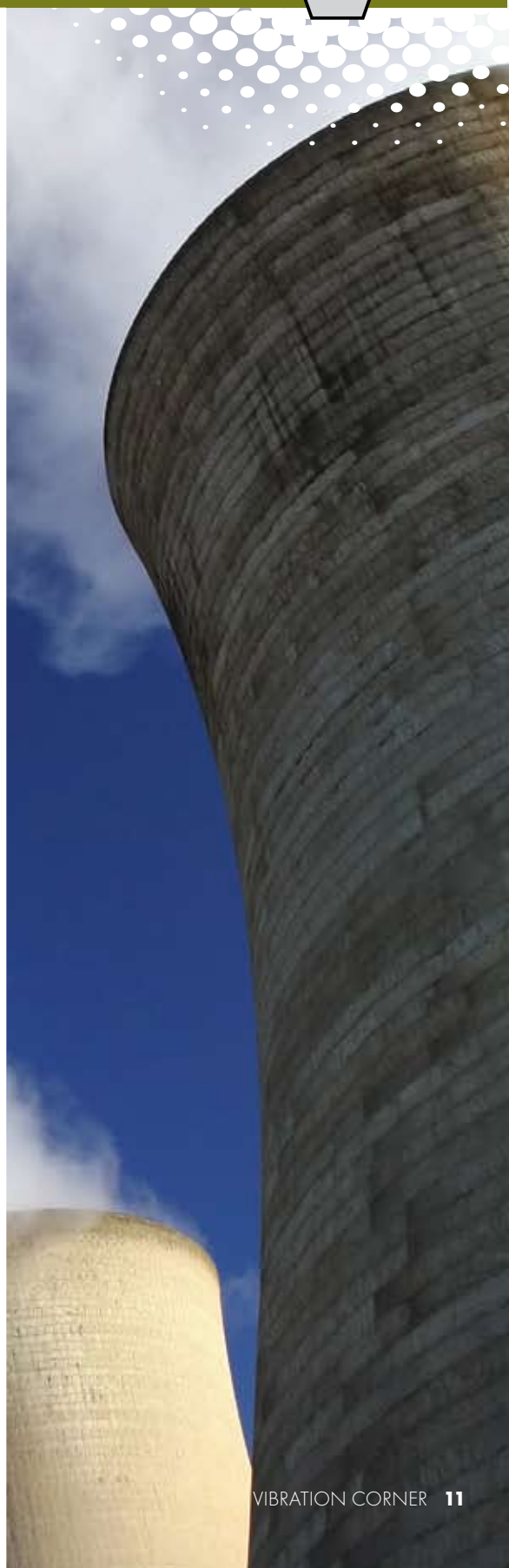
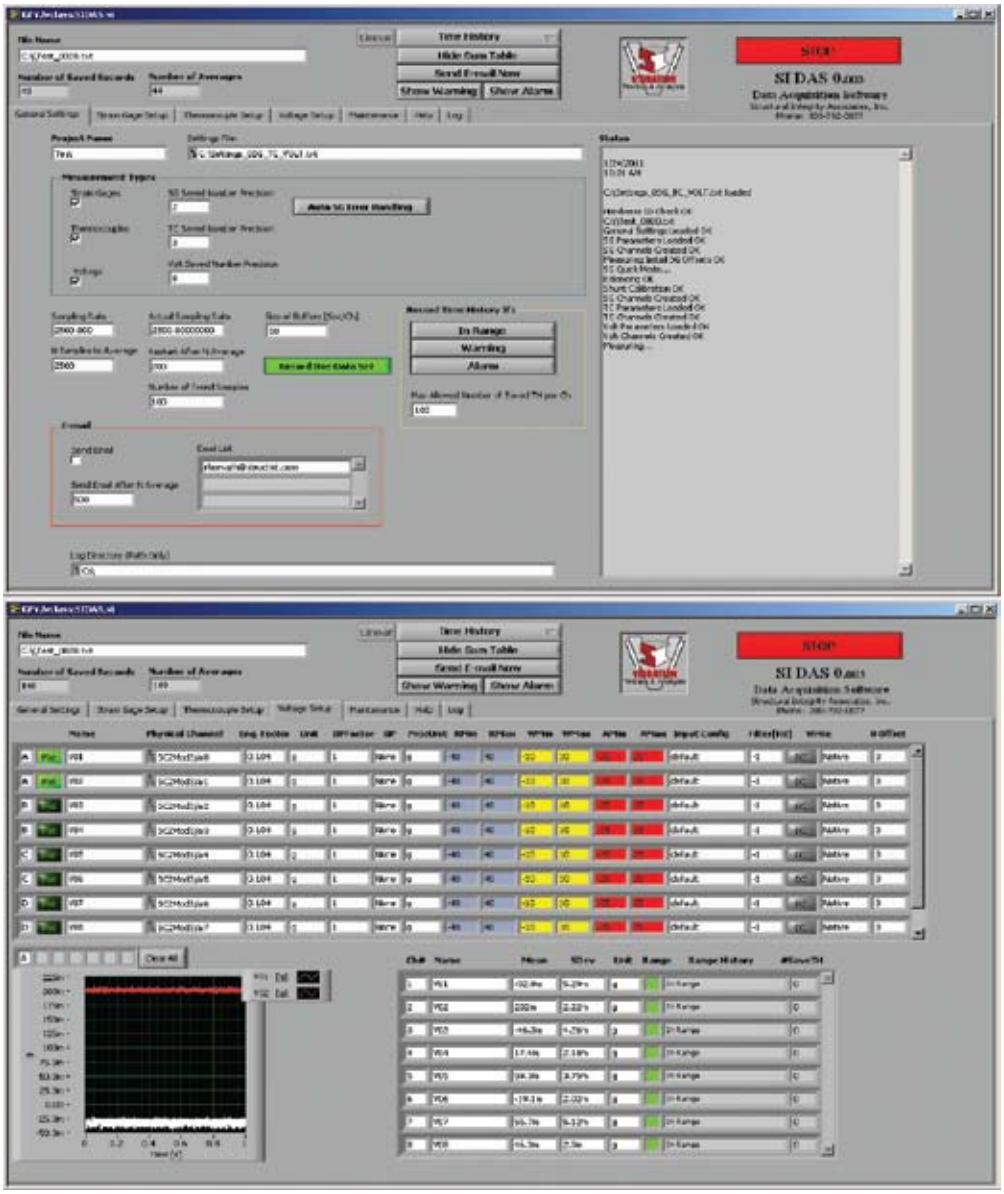


the new MUR power level, which was then used for comprehensive data analysis. The results of the analysis will be used to determine the likelihood of encountering an undesirable resonance condition during Extended Power Uprate in so far as steam flow in the main steam lines.

## SI-DAS™
## UNIVERSAL DATA ACQUISITION SOFTWARE DEVELOPED BY STRUCTURAL INTEGRITY.

We have developed new software to address the increasing need of data acquisition for field applications. The developments targeted are based on many years of field experience. Our software developers had to solve several industrial problems such as accurate long term strain measurement. SI-DAS is able to read data from 90% percent of the sensors used in the industry, operate extended period of time, and run on a simple Windows-based system.



SI-DAS™ User Interface

### SI-DAS MAIN FEATURES:

- Long term acquisition (multiple days, weeks, months even years)
  - Trend only
  - Trend with event capturing
- Short term acquisition: high sampling rate
- Readable text based data file that can be opened with Excel.
- List of sensors:
  - Bridge type sensors (Strain Gauges, Load Cells)
  - Thermocouples
  - Any Voltage or Current output sensors:
    - Accelerometers
    - Pressure and proximity probes
- One measurement with any sensor type combination (for example strain gauges with accelerometers.)
- E-mail sending function (status report)
- User defined warning and alarm settings with optional e-mail notification.
- Stand alone operation
- Data acquisition task is loaded from a text file (Settings.txt).