TakingStock
J&L FIBER SERVICES
The Smart Choice

Spring 2005

Refiner Plate Impact on Refiner Vibrations

Refiner plates impact two of three vibration categories. J&L continues to research and design plate patterns to reduce refiner vibrations. The study we will look at is based on a CD refiner, but plate induced refiner vibrations are applicable to all refiner types.

There are three main categories of refiner vibrations. They consist of:

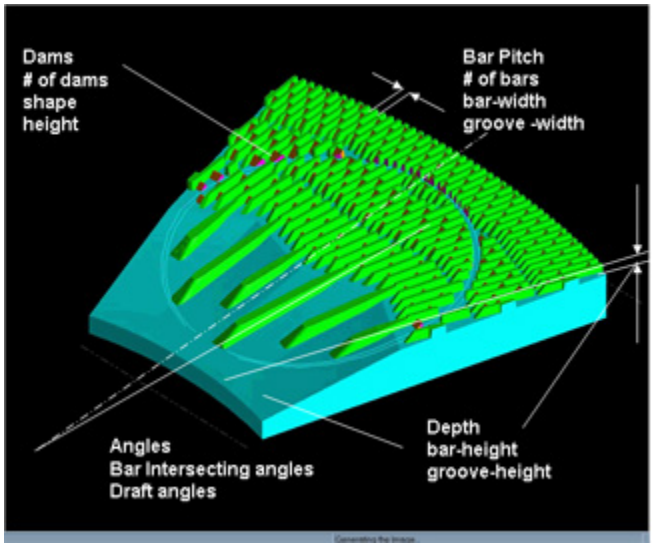
1. Mass unbalance in rotating assembly
2. Process induced vibrations
3. Mechanical vibrations

Mass unbalance in the rotating assembly is caused by plates, holders, shafts, couplings, bolts, etc. Process induced vibrations are caused by operating conditions, control processes and once again, plates. Mechanically induced vibrations are due to items such as failed bearings etc.

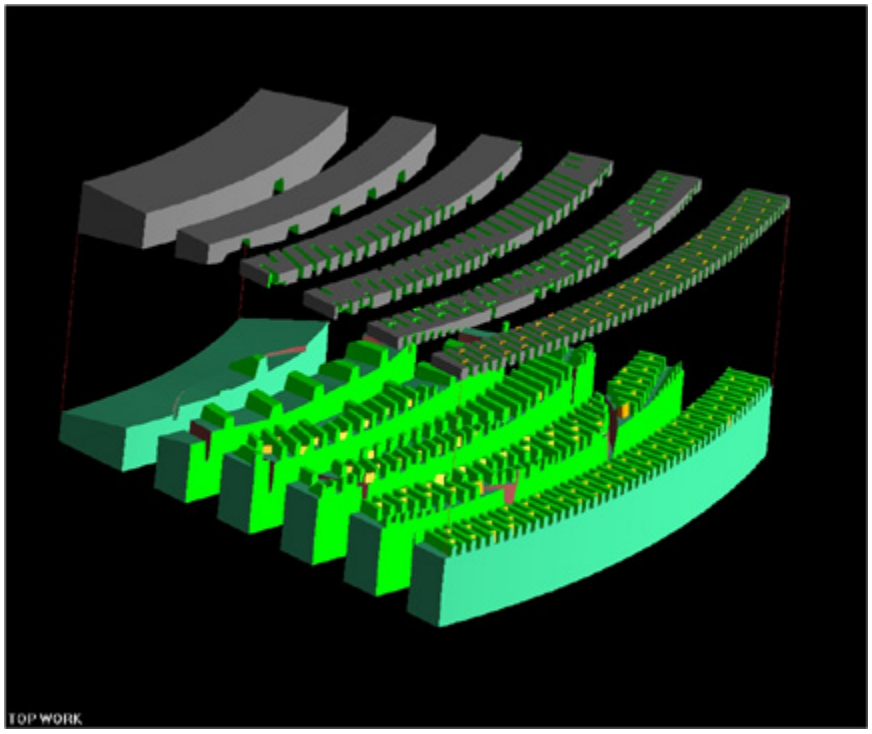
In order to help limit vibration due to mass unbalance in the rotating assembly, J&L balances its own refiner plates in house. Metrics are in place for checking the balancing results. J&L regularly sends out calibration circles to an independent balancing house for evaluation.

Why are these measures so important? If plates are out of balance, the peak vibration would be present at a frequency corresponding to the refiner's rotating speed, with little difference between idle and production. Uneven mass rotating at 1200 or 1800 rpm can cause high amplitude vibrations increasing wear and tear of the refiner.

Process induced vibrations are far more complicated. Vibrations induced by plates can be present at many different frequencies, depending on such plate pattern design parameters as bar pitch, number of bars, bar width, groove depth, intersecting angles etc.



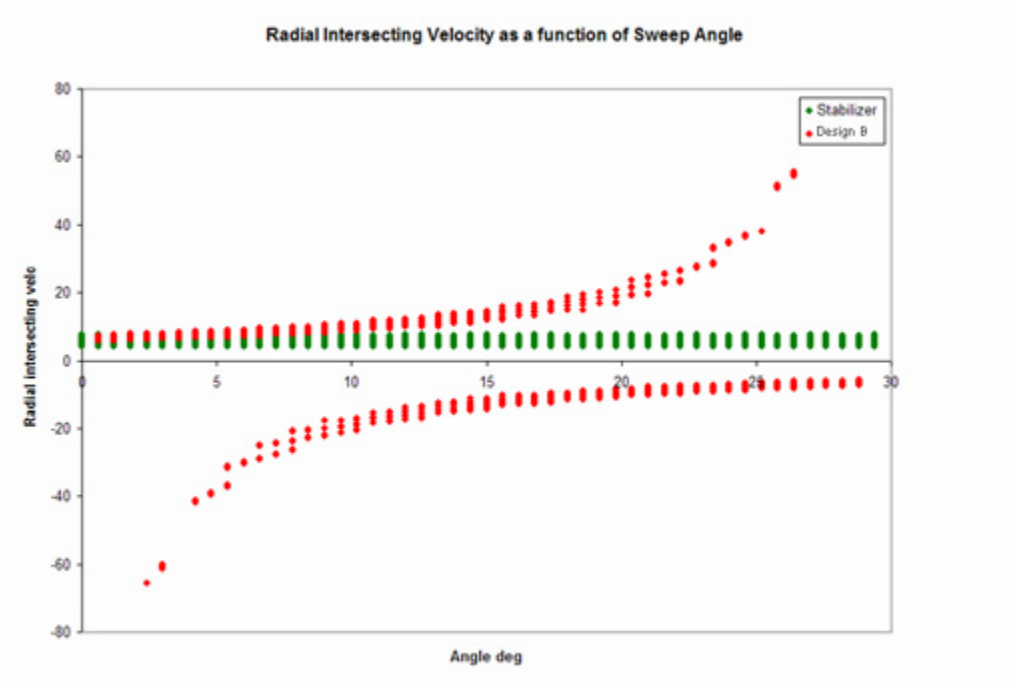
When creating new plate designs, J&L uses computer simulations (see photo below) to slice the plate into different sections. This allows the designer to see how different characteristics of the plate will affect vibrations.



Computer Simulation Results

The research and development carried out by J&L resulted in J&L's Stabilizer plate design. The Stabilizer plates maintain a constant intersecting angle between stator and rotor compared to Design B's parallel plate design.

As the graph below shows, the line corresponding to J&L's Stabilizer plates shows a constant radial intersecting velocity regardless of the sweep angle. In comparison, the line corresponding to Design B shows how the plate's sweep angle affects the radial intersecting velocity.

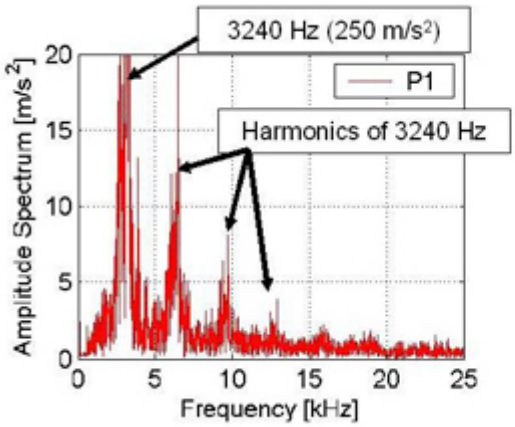


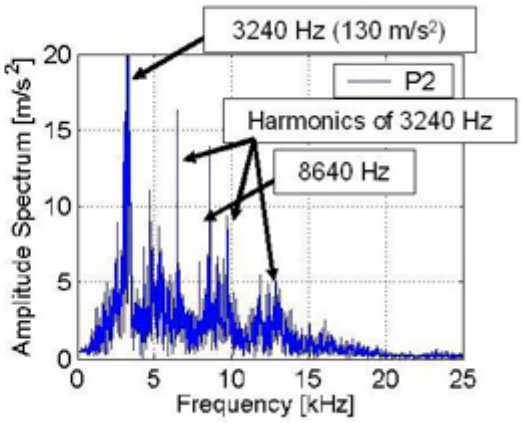
Field Measurements

Field measurements were taken from refiners operating at 1800 rpm. Two refiners ran with Design B and two refiners were installed with J&L Stabilizer plates. Vibration levels were measured at different frequencies at 500ks/s. J&L used a high speed Bruel & Kjaer system with type 4384 accelerometer, type 2635 charge amplifier, and 4 channel high speed data acquisition to measure the field results.

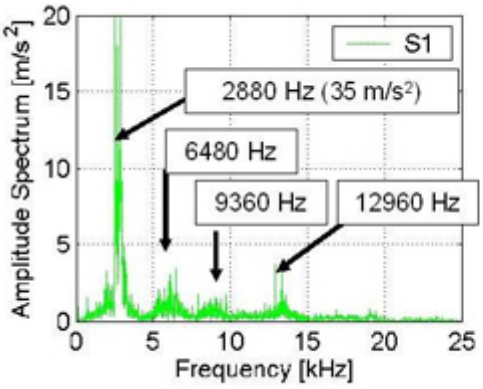
Key Results

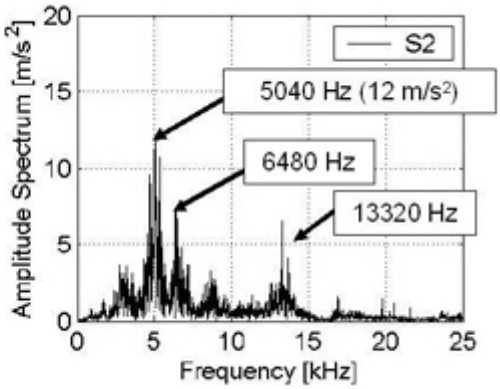
Design B
Design B plates resulted in high vibration at 3240 Hz and experience several harmonics.





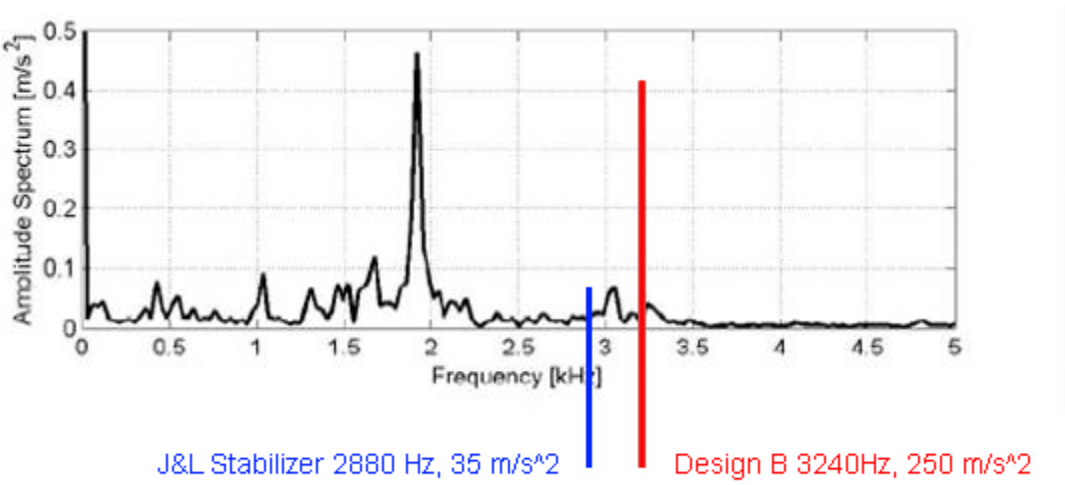
J&L Stabilizer Design
J&L's Stabilizer plates resulted in 8 - 10 times lower amplitude at 2880 Hz and 5040 Hz.





Refiner Natural Frequency
The natural frequency of the refiner is shown in the graph below.

Design B's large process vibration peak is located together with a series of natural frequency peaks of the refiner, just above 3 kHz. J&L Stabilizer plates are lower in amplitude and further away from the 3 kHz pole, which may explain the large difference in vibration amplitude between the two plate designs.



Summary

J&L Stabilizer refiner plates produce less vibrations due to the constant intersecting angle. Computer simulations have been confirmed by field measurements. The field measurements show a significant difference between the constant intersecting angles of the J&L Stabilizer plates and the parallel bars of Design B.

Process vibrations close to the natural frequency of the refiner can be very damaging. J&L continues to design plate patterns that optimize the power distribution across the zones and avoid refining frequencies in harmony with the refiner's natural frequency.

J&L Fiber Services, Inc.
809 Philip Drive
Waukesha, Wisconsin 53186
U.S.A.
Phone: 262-544-1890
Fax: 262-547-8166
www.jlfiberservices.com