UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

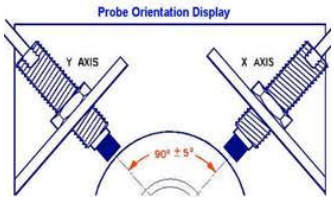
Senior Design Project Description for SPRING 2017
Project Title: Rotation System for Total Indicator Runout (BALDOR_TIR)

Supporter: Baldor ABB
Supporter Technical Representative: ASSIGNED
Faculty Mentor: _____ ASSIGNED __X__ TBD (check one)
Single Team __X__ Dual Team _____ (check one)
Personnel (EN/ET): __1__ E, __1__ Cp, _____ Cv, __4__ M, _____ SE
(Complete if the number of students required is known)
Expected person-hours: (250 per student)

Description of Project:

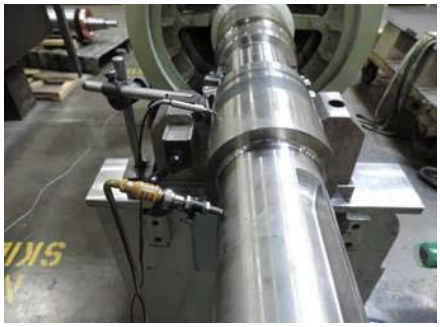
The ABB Kings Mountain facility recently expanded product lines being manufactured here to include machines up to 10,000 horsepower. This new line of AC machines is significantly larger than the legacy product built here and this new line is creating a new set of challenges in material handling.

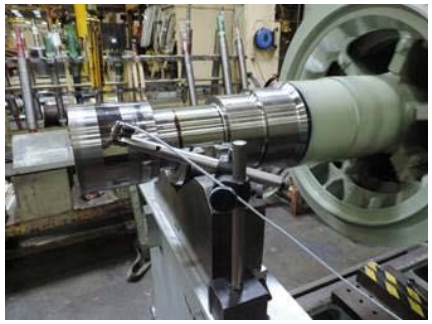
A majority of these machines utilize dual non-contacting proximity probes at each bearing to monitor vibration levels during operation. Probe orientation is shown below and on these large machines they are located outboard of the bearings in a fully assembled machine.



The non-contacting proximity probe is part of a transducer system that also includes an extension cable and a proximitor. This system measures the gap voltage variation between the probe tip and the probe track on the rotating element. This gap continuously changes mostly due to the shaft vibration, but can also include out of roundness of the probe track, concentricity between the probe track and the bearing journal, surface defects on the probe track area and variations in the magnetic properties of the shaft material. All of these non-vibration dependent changes of the gap between the shaft and the probe tip are defined as Total Indicator Runout (TIR) or simply runout. This runout will appear in the vibration readings and generates measurement errors. To identify potential errors related to runout we are required to measure the runout at both probe track areas during machine performance testing but also prior to assembly. This test is known as slow roll runout and is a condition in oil film bearing machines which the rotating assembly rotates between 200 to 300 rpm. At this speed the dynamic effects are minimal and the vibration is almost non-existent. In this condition, all the proximity probe readings will show potential mechanical defects at the probe track (out of roundness, surface finish, concentricity, etc.) and the electromagnetic defects in the shaft material. At the 200-300 rpm speed range, all of the probe recorded displacements are almost purely runout without any vibration. The total runout is recorded and must meet the required limit set forth by the end user specifications. The photographs below show

runout levels being measured prior to assembly. The rotating assembly is positioned between two v-blocks and resting on the bottom halves of bearings. Proximity probes are positioned and then the assembly is rotated to the slow roll speed.





Initial Project Requirements (e.g. weight, size, etc.):

The new AC product line has rotating assemblies weighing up to 18,500 lbs., with inertias up to 25,000 lb-ft2. The current process for measuring slow roll was developed for rotating assemblies weighing up to 4,600 lbs., with inertias up to 3,000 lb-ft2.

A mechanical/electrical system capable of rotating these large rotating assemblies, ramping up and maintaining a speed between 10-25 rpm all while limiting shaft deflection is required. The system will also need to incorporate safety features to eliminate manual operations and provide protective features during rotation. The outer diameter of these assemblies may be as large as 40 inches with an overall shaft length of 68 inches.

The system shall be capable of rotating all ABB/Baldor-Kings Mountain rotating assemblies at constant speeds of 10-25 rpm with limited shaft deflection for an indefinite period of time. The system will also need to incorporate safety features to eliminate manual operations and provide protective features during rotation. The total materials budget is $5000.

Expected Deliverables/Results:

A complete system that is capable of rotating shall be designed, implemented, and tested in our Kings Mountain production facility. Testing will need to verify that the system can successfully rotate the required rotating assemblies and not impede the runout data collection process. All design documentation (drawings, calculations, etc.) should be maintained and provided in conclusion and both a maintenance plan and operating instructions should be developed.

List here any specific skills or knowledge needed or suggested (If none please state none):

-None-