



HEALTH MONITORING SYSTEM FOR GAS TURBINES

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HEALTH MONITORING SYSTEM FOR GAS TURBINES

- Application
 - Aircrafts Engines
 - Power Plants
- Health monitoring system to determine failure in components that affect its efficiency.



INVESTIGATION STAGES

- This investigation was divided in four stages
 - Gas turbine research and design.
 - Test Gas Turbine Manufacture.
 - Gas Turbine Fails, Maintenance, and Monitoring research.
 - Gas Turbine Monitoring System design and tests.



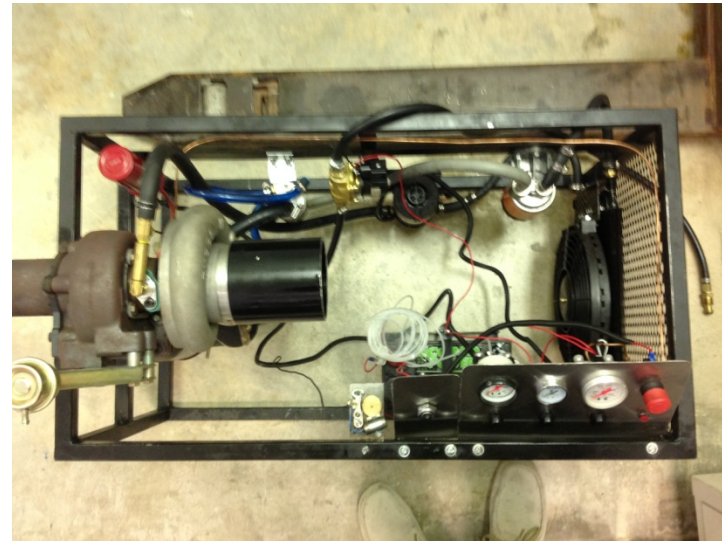
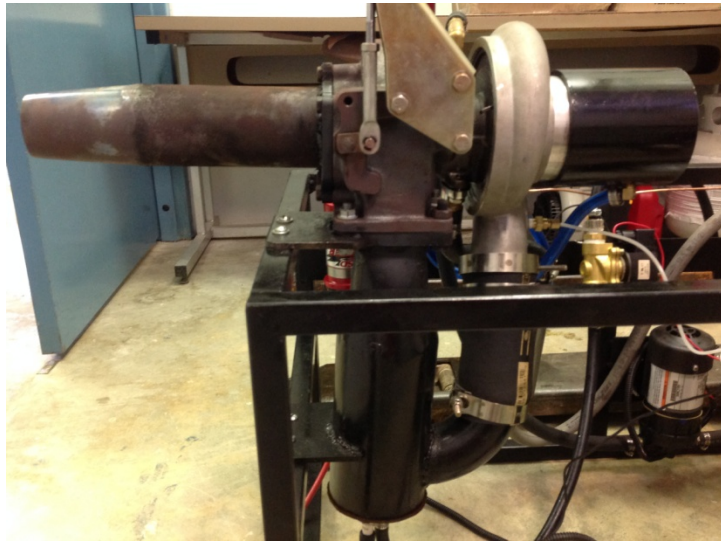
FIRST STAGE

- Gas turbine research and design.
- Results
 - Understand the gas turbine cycle (Rankine Cycle).
 - Learn about the gas turbine components and their function.
 - Select components for design.
 - Design gas turbine.



SECOND STAGE

- Test Gas Turbine Manufacture.



THIRD STAGE

- Gas Turbine Fails, Maintenance, and Monitoring research.
- Components Failure
 - Effects
 - Loss of efficiency
 - Poor performance
 - Engine fail
 - Hazard to close people
 - On time replacement of damaged components will represent saving in cost of operation, will ensure service availability and obtain the most performance of the turbine components.



ACTUAL GAS TURBINE MONITORING

Ideal System

- Temperature
- Pressure
- Oil System
- Vibration
- Life Usage
- Additional parameters

Actual Monitoring System

- Aerodynamic Performance
 - Pressure Ratio
 - Fuel Flow
 - Speed
 - Exhaust Gas Temperature
 - Throttle Position
- Mechanical Performance
 - Vibration Amplitude
 - Oil Consumption



HEALTH MONITORING SYSTEM FOR GAS TURBINES

- The idea of this research is to design a system able to monitoring the vibrations of a gas turbine and from that information determine if there is a components that requires replacement.
- It was reviewed some works to determine the viability of designing such system to work permanently on gas turbines, even when during flights in the case of aircrafts engines.

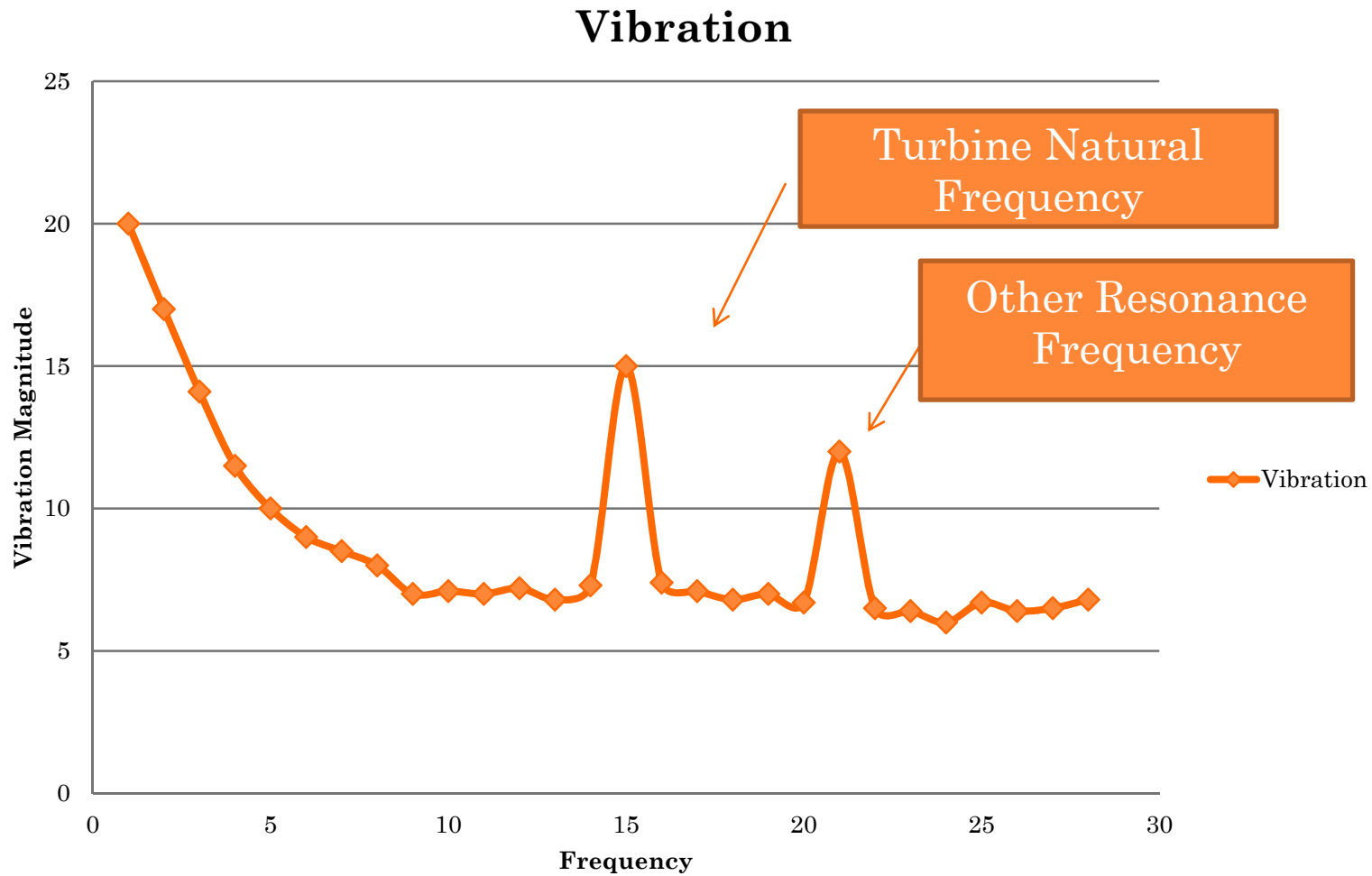


RESEARCH INFORMATION

- Inspection of the turbine sometimes involves replacement of good components.
- Gas Turbines vibration may bring information about the components or the gas turbine status.
- Torsional vibration monitoring bring a reliable information about damage components.
- Torsional vibration curve is different for any gas turbine design.
- Damages can change the gas turbine efficiency and vibration.
- Damages affects the torsional vibration curve.



GAS TURBINE VIBRATION CURVE



DAMAGE EFFECTS ON GAS TURBINE VIBRATION

- Unbalanced Shafts
 - Unbalanced force vibration.
- Flow Alterations
 - Affect flow vibration
- Material Stiffness
- Erosion (Diminishing mass)
 - Affect turbine natural frequency



FOURTH STAGE

- Gas Turbine Monitoring System design and tests.
- The proposed experimental system.
 - Two accelerometers
 - Optical tachometer sensor
- Accelerometers
 - Obtain information about the linear acceleration.
- Optical Tachometer Sensor
 - Obtain information about changes in rotational acceleration.



PROPOSED EXPERIMENTAL SYSTEM

- The proposed system will use the tachometer to obtain the changes in the rotational velocity of the turbine.
- One of the accelerometers will be able to obtain the information about the gas turbine vibration.
- The other accelerometer will obtain information about the support vibration in order to separate the Internal gas turbine vibration from the ambient vibration.



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