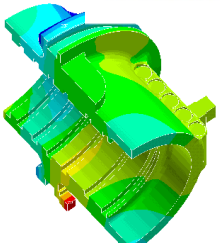
PROASPECT

ENGINEERING DESIGN SOLUTION

design@pro-aspect.com

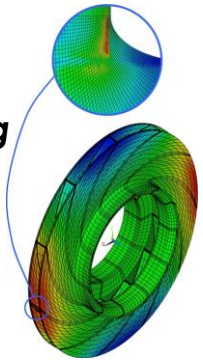
DESIGN CONSULTANCY SPECTRUM

- Rotor Dynamics (Linear/Non-Linear Analysis)
- Dynamics and Simulation
- Field Failure Study / Fracture and fatigue analysis
- Life estimation / Design review and modification
- Failure Cause & Impact Study
- Heat transfer prediction / Flow analysis CFD



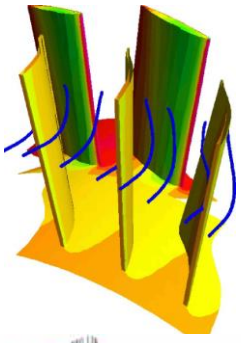
FEA – Finite Element Analysis

- Machine components – *impellers, bearing housing*
- Machinery Foundation – *static and dynamic study*
- Piping - *acoustic pulsation*



CFD – Computational Fluid Dynamics

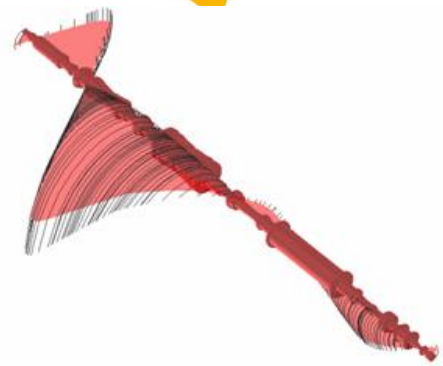
- Prediction of fluid / aero- dynamic interaction
- Steady & Unsteady flow
- Rotor dynamic Coefficient
- Transient Rotor-Stator Interaction
- Leakage Flow
- Stall and Cavitations phenomena
- Fluid-Structure Interaction

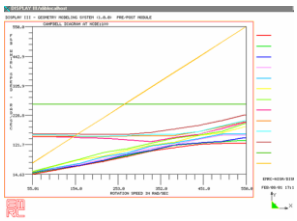


ADVANCE ENGINEERING ANALYSIS

ROTOR DYNAMIC ANALYSIS

- Critical Speed Map, Natural Frequencies
- Unbalance Response and Mode Shapes
- Asynchronous Forcing
- Rotor Dynamic Stability / instability
- Lateral / Torsional vibration study
- Bearing – *journal, anti-frictional etc*
- Seals – *labyrinth, honey-home etc*
- Foundation Excitation
- *Turbine, Compressors, pumps, propellers etc*





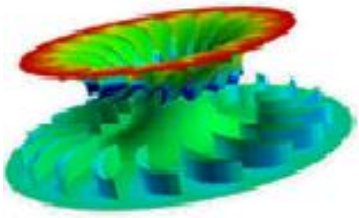
FAILURE PREDICTION / ANALYSIS

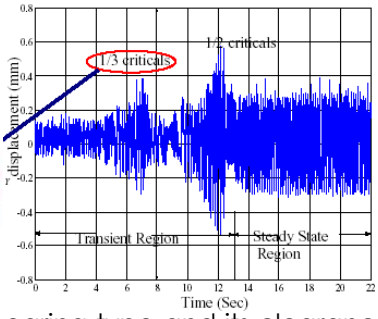
HOW TO AVOID CHRONIC FAILURES?

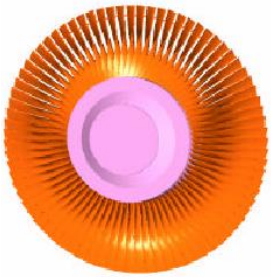
- **Centrifugal Compressors**
- **Centrifugal Pumps**
- **Axial Compressors**
- **Gas and Steam Turbines**
- **Motors and Generators**
- **Turbo-Expanders**
- **Reciprocating equipments**
- **Free-Free Mode**
- **Critical Speed Map**
- **Natural Frequency / Mode Shape**
- **Unbalance Response**
- **Asynchronous Forcing**
- **Torsional Rotor Dynamic Stability**
- **Flexible Rotor Balancing**

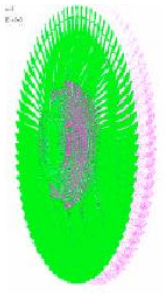
Managing of specialized high speed equipments become complicated and tougher Finding solution always requires complete understanding of rotor dynamic mechanism and it's vibratory behavioral response for various failure modes and excitation forces.

Research indicates that most of the plant critical equipment's chronic failures are due to inadequate design / incompatible components such as coupling / bearing etc.





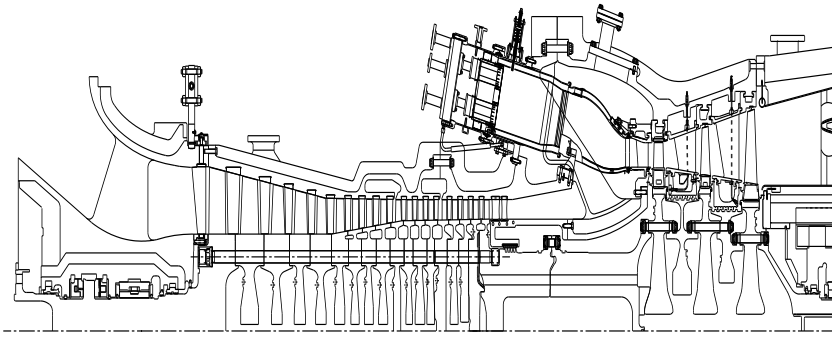


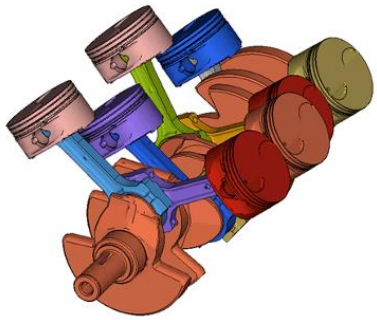


The factors like coupling / bearing type and its clearance / deviation in fitness tolerance / rubbing / unbalance / lubricant properties / foundation support may attributes to worst dynamic behavior and abnormal vibration problem

Analytical modeling & Lateral cum Torsional study would help to avoid failures.

KNOW YOUR MACHINERY DYNAMIC CHARACTERISTICS TO MANAGE AS WELL AS MAINTAIN IT



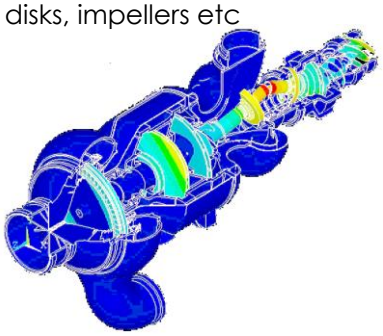


Finite Element Model / Natural frequencies, mode shapes of the system / Campbell diagram / Forced vibration amplitudes at the critical locations / System Natural frequencies / mode shapes / Forced vibration response of the system / Torsional response of the system for possible torsional excitations / ODS - Animation plots of the salient mode shapes.

ROTOR DYNAMIC ANALYSIS

Finite element / computational Rotor dynamic & torsional Analysis

i. Dynamic analysis of rotor and bearing system
ii. Stress, fatigue and failures: casings, blades, disks, impellers etc
iii. Natural frequency identification



Rotor stability / Shaft lateral / torsional critical speed analysis

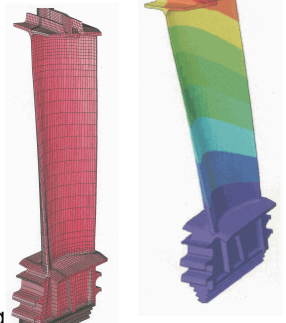
- Review machine failure history
- Failure modes and definition
- Design audit
- Test & Measurements Operating Deflection Shape Analysis
- Forced Response Analysis

TRANSIENT ANALYSIS

Modal Analysis – to determine the natural frequency of the system for various excitational forces typical methods are ODS – Operational Deflection Shape and FRF – Frequency Response Function.

Critical speed analysis – Mode shape, unbalance response, whirl chart etc

- Transient response study is the method of analyzing forced dynamic response.
- Simulate the dynamic behavior of a system in response to various excitation frequencies.



FATIGUE LIFE PREDICTION

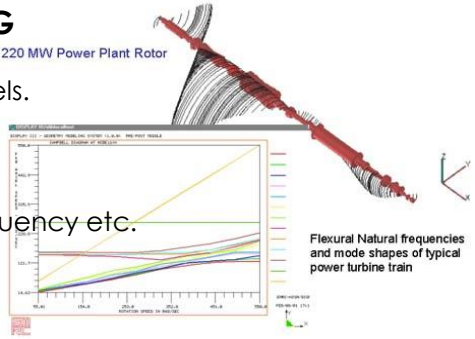
- Review stress and load history, stress concentration effect, material fatigue
- Analysis for stress life, strain life, fractures mechanics.
- Determine component residual life (cycles to failure, damage)

FATIGUE AND FAILURE ANALYSIS

- Field measurements to describe load variation over time, or from design loa
- time histories of real life loading to obtain fatigue life of a structure.
- Total life consists of crack initiation phase, and crack propagation phase.
- Calculates cycle by cycle damage of the structure in comparison to a known material, test piece data.
- Following initial fatigue estimation for load cycles up to the present time, extrapolation of remaining life is undertaken.
- From design stage or current conditions, "what if" scenarios may be undertaken.
- Benefits of structural modifications, and/or loading conditions can be evaluated.

PRODUCT DEVELOPMENT / PROTOTYPE / RE-ENGINEERING

- Design documentation. - detailed 2-D drawings, 3D solid models.
- Product Modeling, Product Design and Development
- Multi-Body system Analysis
- Non - Linear Analysis - Geometric and Material Nonlinearity.
- Optimisation - Weight and cost reduction, altering natural frequency etc.
- Test Rig development for product validation and testing



Flexural Natural frequencies and mode shapes of typical power turbine train

WHERE WE OPERATE

- **Singapore**
- **Malaysia**
- **Indonesia**
- **Middle East**
- **India**

- **Manufacturing – Petrochemical, Electronic, Pharmaceutical etc**
  - Predictive maintenance management
  - Root Cause Failure Analysis / instrumentation system
  - Correlation of process related problem and mechanical failures study
- **Power, Utility, Steel, Paper, Waste treatment plants**
  - Proactive Maintenance Program / installation of on-line vibration monitoring system
  - In-situ balancing of rotor – *rigid & flexible rotors of both symmetric & asymmetric*
  - Analytical Design (FEA) & Experimental study (Modal Analysis)
  - Transient analysis during startup / coast down
- **Navy, Air force, Military, Defense – Segments**
  - Gas turbine test rig design
  - Helicopter structural study
  - Failure analysis
  - In-situ balancing of gas turbine rotor
- **Transport – Aircraft, Railway, Ship & Off-shore**
  - Vibration and noise predictions *at the design, construction and repairing stages*
  - Advanced dynamic analysis: *Analytical design (FEA / FEM) and Experimental (Modal Analysis)*
  - Predictive maintenance for failures identification.
  - Structural vibration testing and measurement
  - Measurement of ship vibration – *during pre-overhaul / Dry dock / Sea trails*
- **OEM, Engineering Consultant / Contractors etc**
  - Turnkey project support
  - Startup / commissioning test






SUPPORT SERVICES

With our associates, we offer wide range of support services such as repairing / overhauling / maintenance / installation of mechanical and Electrical rotating machineries esp. in Singapore / Malaysia

We ensure that services and products provided to our customer surpasses their expectations and always affordable.

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