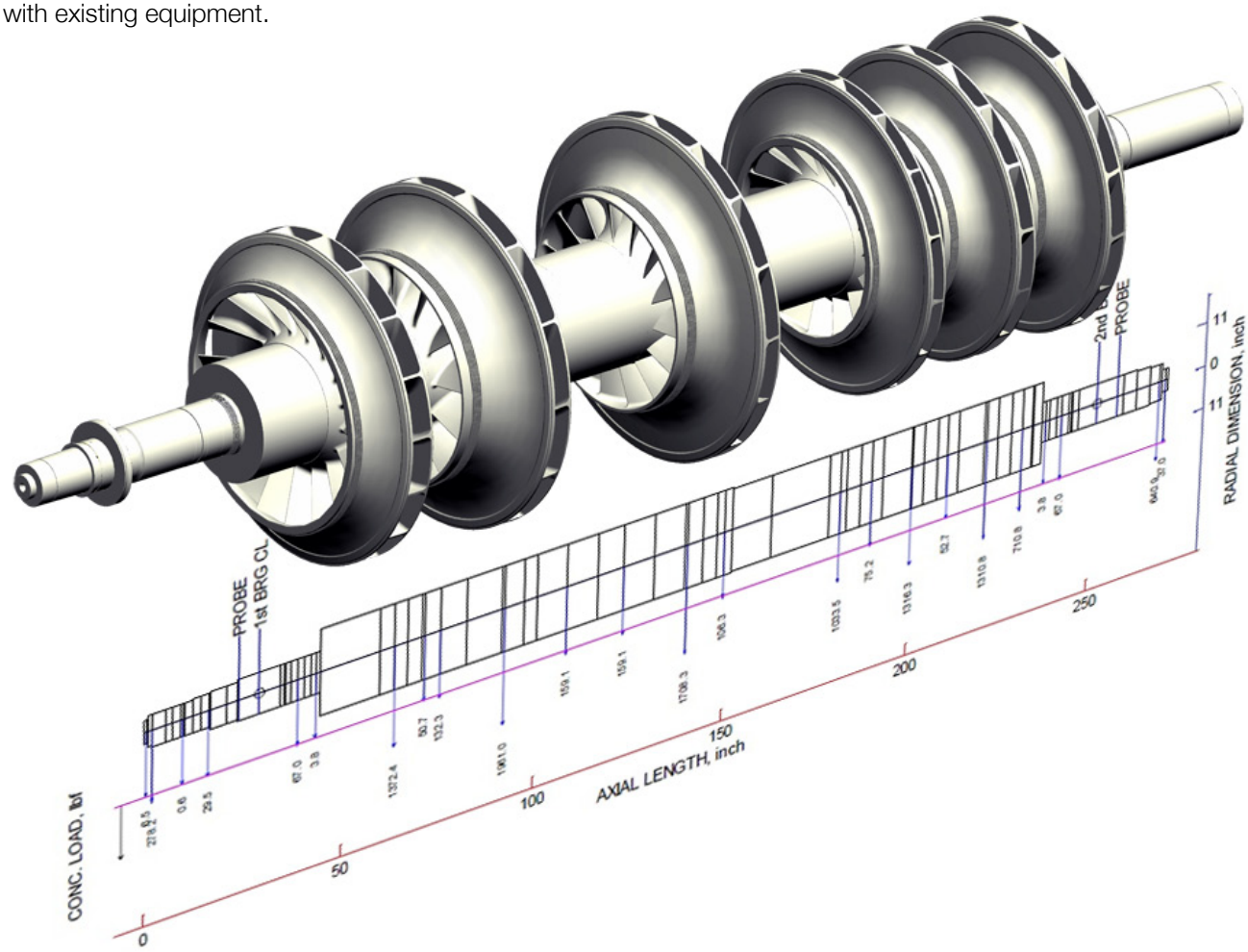
Elliott Rotor Dynamic Studies

Rotor dynamic studies examine the lateral and torsional vibrations within rotating equipment strings during operation. Unaddressed vibration can cause internal rubs, severe component damage, unplanned outages, or even catastrophic failures. Sources of rotor vibration can include rotor unbalance; operation at critical speed; journal bearing instabilities; contact between the rotor and stator; and aerodynamic or hydraulic instabilities.

Elliott conducts rotor dynamic studies on all new and modified turbomachinery equipment to ensure safe, reliable, and long-term performance. Our evaluation adheres to the American Petroleum Institute (API) rotor dynamic standards, in addition to our internal acceptance criteria developed over more than 100 years of designing and manufacturing rotating equipment.

Elliott's rotor dynamic analyses accurately predict the response of a rotating system and determine if this response is acceptable. An acceptable response ensures that operating speeds are sufficiently separated from critical speeds, and that the equipment is stable with an adequate amount of damping. To understand overall system performance when conducting a rotor dynamic study, Elliott evaluates each piece of equipment in a string and the equipment's connecting couplings. Elliott also uses rotor dynamic studies to troubleshoot operational problems with existing equipment.



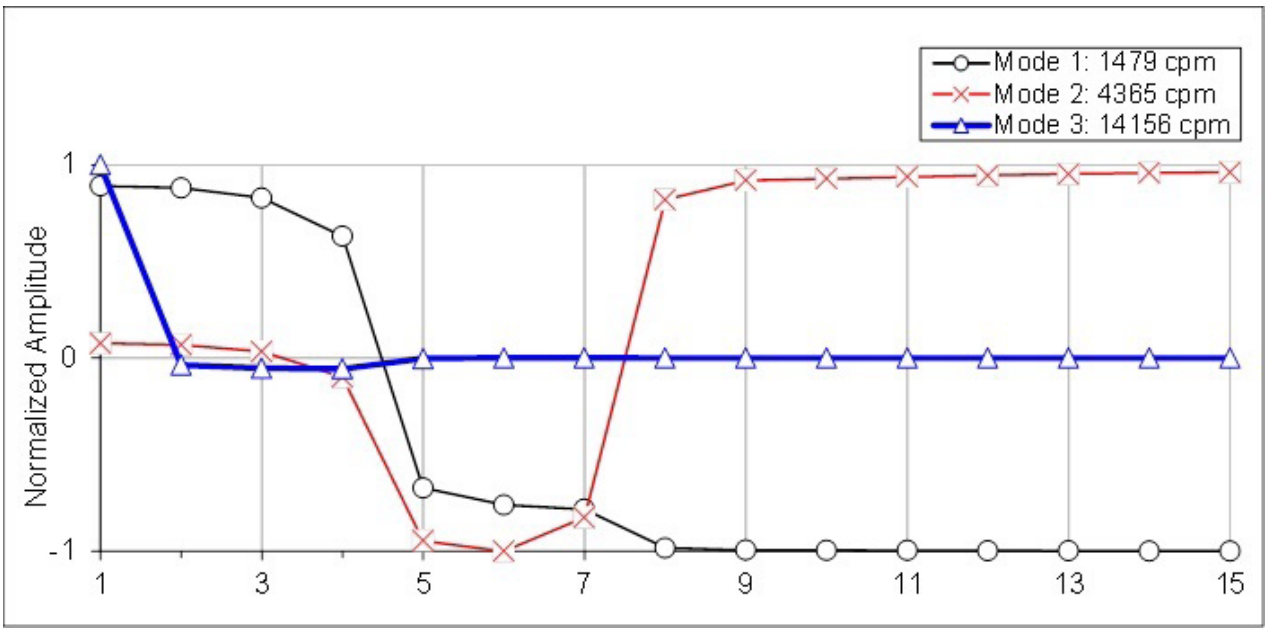
Typical Elliott rotor dynamic studies are:

- Unit lateral analysis for all new equipment, rerates, and modifications
- Train lateral analysis for coupled machines
- Train torsional analysis for all new equipment strings, rerates, and modifications
- Transient torsional analysis per industry standards, induction and synchronous motor start-up, variable frequency drive operation, and motor or generator short circuits

Lateral Analysis

Lateral analysis examines rotor vibration within a single unit or in a train of rotating equipment. Elliott's equipment evaluation includes undamped critical speed analysis, unbalance response analysis, and stability analysis.

- Undamped critical speed analysis uses a critical speed map and mode shapes to predict overall system behavior.
- Unbalance response analysis verifies that there is sufficient margin between operating speeds and critical speeds. Continuous operation at or near critical speeds can produce amplified vibrations that can result in component failure.
- Stability analysis indicates how quickly vibrations in the rotor system will dissipate.



Torsional Analysis

Torsional analysis evaluates the twisting interaction between the rotors and couplings in an equipment string. Each component of the string, such as a motor, gear, or compressor, is evaluated. Elliott uses the finite element method (FEM) to identify rotor stress points when conducting torsional analysis. Once the equipment string is isolated, engineers evaluate overall system operation using critical speed analysis, steady-state analysis, and transient analysis.

- Critical speed analysis calculates the torsional natural frequencies (TNF).
- Steady-state stress analysis is used when TNFs are unavoidable, such as in a variable speed drive train with a wide speed range. The analysis determines whether the system is operating within acceptable vibration parameters or if modifications are necessary.
- Transient analysis examines start-up or short circuit conditions in motor-driven equipment trains.

Elliott Group's commitment to excellence ensures that customers benefit from the most advanced procedures and technology for evaluating rotor dynamics. Elliott provides special terms on rotor dynamic studies to customers who choose Elliott to rerate or modify an equipment string. Customers throughout the world turn to Elliott as a single, comprehensive source of service, support, and parts for all types of turbomachinery, regardless of the original manufacturer.

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