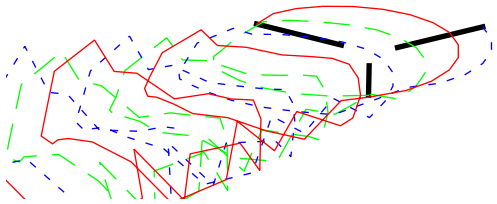
CAMRAD II

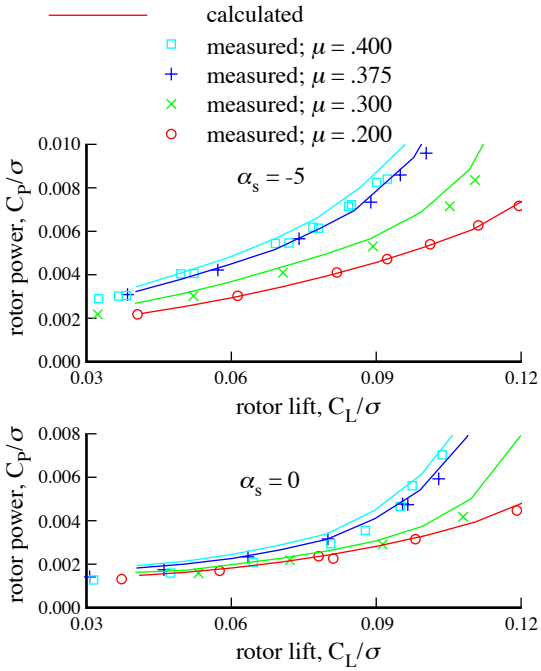
COMPREHENSIVE ANALYTICAL MODEL OF ROTORCRAFT AERODYNAMICS AND DYNAMICS

CAMRAD II is an aeromechanical analysis of helicopters and rotorcraft that incorporates a combination of advanced technology, including multibody dynamics, nonlinear finite elements, structural dynamics, and rotorcraft aerodynamics. For the design, testing, and evaluation of rotors and rotorcraft — at all stages, including research, conceptual design, detailed design, and development — CAMRAD II calculates performance, loads, vibration, response, and stability — with a consistent, balanced, yet high level of technology in a single computer program — applicable to a wide range of problems, and a wide class of rotorcraft.

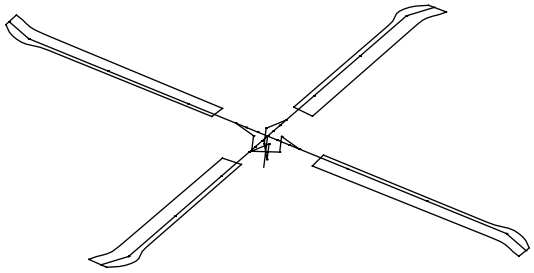
Calculated Forward Flight Free Wake Geometry



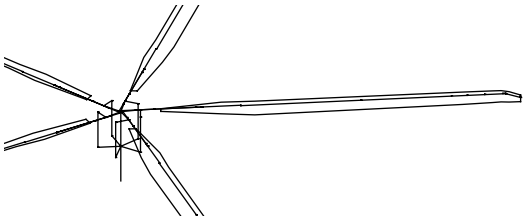
Rotor Forward Flight Performance



Advanced Technology Rotor Systems



Bearingless Rotor with Swept-Tip Blades



CAMRAD II uses a building block approach to achieve flexibility in the model of the dynamic and aerodynamic configuration. Hence it can model the true geometry of a rotorcraft, including multiple load paths (such as a swashplate and control system, lag dampers, tension/torsion straps, and bearingless rotors); vibration control devices (such as pendulum absorbers or active control); arbitrary elastic axis and arbitrary hinge order; drooped and swept tips; and dissimilar blades. CAMRAD II provides a powerful analysis capability, including advanced rotor aerodynamics; rigorous kinematics and dynamics (with consistent structural loads and dynamic response, and general interfaces between aerodynamic and structural dynamic components); and general transient solutions. For ease of use a shell is provided to build typical rotorcraft and rotor models, while the core input capability always gives complete flexibility to define and revise the model. A range of components and modeling options makes it a practical engineering tool, allowing the best balance of efficiency and accuracy to be found for a particular problem. CAMRAD II offers a common tool among organizations, and a design for growth that makes it an appropriate platform for future developments, for continuing access to new technology.

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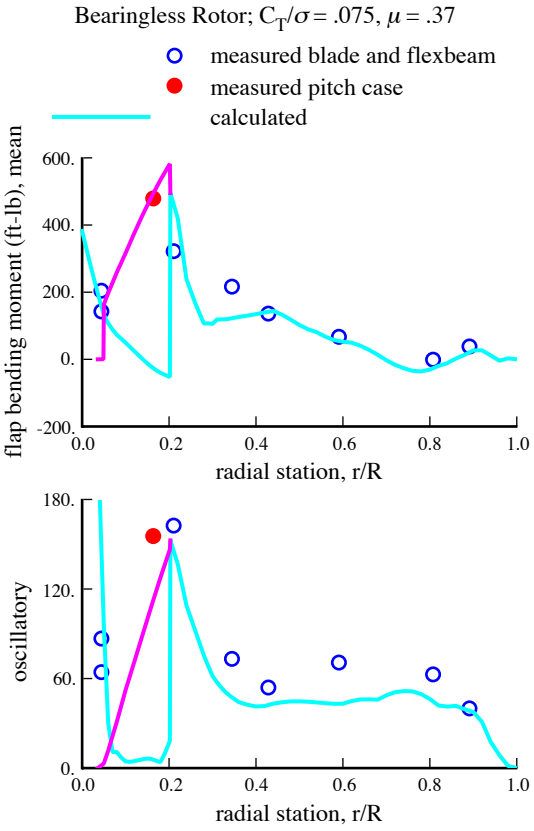
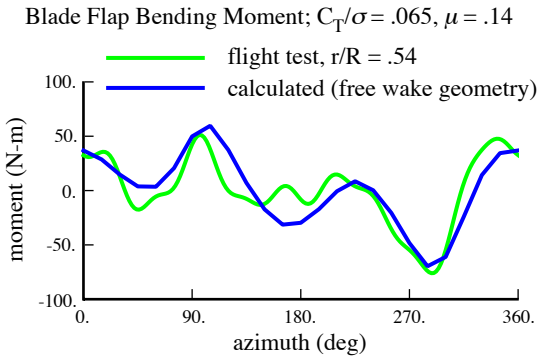
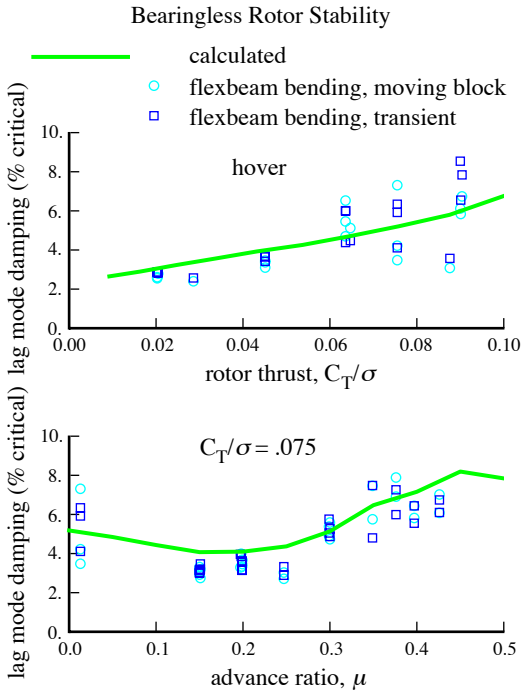
CAMRAD II performs a nonlinear dynamic/static analysis of an aeromechanical system. Flexibility and generality of the system configuration are obtained by assembling standard components with standard interfaces, and solving the system by standard procedures. The components available include structural dynamic, aerodynamic, wake and wake geometry, and differential equation models. These system pieces constitute the core analysis, providing a flexible, building-block oriented modelling capability. In addition, the analysis has a shell that constructs the core input for typical rotorcraft and typical problems.



The analysis solves differential, integral, static, and implicit equations for the motion of the system, and evaluates required output quantities from the response. The trim task finds the equilibrium solution (constant or periodic) for a steady state operating condition. The transient task integrates the equations in time for a prescribed excitation. The flutter task obtains and analyzes differential equations, linearized about trim, perhaps with quasistatic reduction for a stability derivative model.



The shell constructs the input for arbitrary one-rotor or multi-rotor helicopter or tiltrotor; in free flight or a wind tunnel; with N-bladed rotors having articulated, hingeless, teetering, gimballed, or bearingless root configurations, including a swashplate model. The aerodynamic model includes a sophisticated wake analysis to calculate the rotor nonuniform induced-velocities, using rigid, prescribed or free wake geometry.



CAMRAD II was developed by Dr. Wayne Johnson of Johnson Aeronautics, and is marketed and distributed by Analytical Methods, Inc. under a joint agreement. Full support of the software is provided, including installation, training, maintenance, and applications. Contact Johnson Aeronautics or AMI for further information regarding CAMRAD II.