Investigating dynamics in the system consisting of a rotor and a casing of an aviation gas-turbine engine in the case of a fan blade-out

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While the probability of a fan blade-out in a gas-turbine aviation engine is extremely low, it is not zero. A blade-out may lead to a catastrophe. Expensive testing is required to prove that there will be no dangerous consequences if the blade fails. This means that it is important to use suitable computational techniques to develop design steps to decrease the loads affecting force diagram nodes in the engine in the case of a blade-out. The paper presents an approach to solving the dynamic force problem in the system consisting of a rotor and a casing when a fan blade-out causes instantaneous unbalance. We state and solve this non-linear, non-steady-state problem, accounting for blade contact and compliance in the fan blade row, as well as for variations in the rotor angular frequency. We analyse the effect that certain engine component parameters have on the forces transmitted from the rotor to the casing system.

Keywords: *rotor dynamics, unbalance, blade-out, exceeding critical angular frequency, contact problems, blade compliance, dynamic loads*

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