System-Level Design of a Shape Memory Alloy Actuator for Active Clearance Control in the High-Pressure Turbine

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BiblioGov. Paperback. Book Condition: New. This item is printed on demand. Paperback. 24 pages. Dimensions: 9.7in. x 7.4in. x 0.1in.This paper describes results of a numerical analysis evaluating the feasibility of high-temperature shape memory alloys (HTSMA) for active clearance control actuation in the high-pressure turbine section of a modern turbofan engine. The prototype actuator concept considered here consists of parallel HTSMA wires attached to the shroud that is located on the exterior of the turbine case. A transient model of an HTSMA actuator was used to evaluate active clearance control at various operating points in a test bed aircraft engine simulation. For the engine under consideration, each actuator must be designed to counteract loads from 380 to 2000 lbf and displace at least 0. 033 inches. Design results show that an actuator comprised of 10 wires 2 inches in length is adequate for control at critical engine operating points and still exhibits acceptable failsafe operability and cycle life. A proportional-integral-derivative (PID) controller with integrator windup protection was implemented to control clearance amidst engine transients during a normal mission. Simulation results show that the control system exhibits minimal variability in clearance control performance across the operating envelope. The final actuator design...

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