

Abstract Submitted
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Unsteady adjoint of a gas turbine inlet guide vane CHAITANYA TALNIKAR, QIQI WANG, Massachusetts Inst of Tech-MIT — Unsteady fluid flow simulations like large eddy simulation have been shown to be crucial in accurately predicting heat transfer in turbomachinery applications like transonic flow over an inlet guide vane. To compute sensitivities of aerothermal objectives for a vane with respect to design parameters an unsteady adjoint is required. In this talk we present unsteady adjoint solutions for a vane from VKI using pressure loss and heat transfer over the vane surface as the objectives. The boundary layer on the suction side near the trailing edge of the vane is turbulent and this poses a challenge for an adjoint solver. The chaotic dynamics cause the adjoint solution to diverge exponentially to infinity from that region when simulated backwards in time. The prospect of adding artificial viscosity to the adjoint equations to dampen the adjoint fields is investigated. Results for the vane from simulations performed on the Titan super-computer will be shown and the effect of the additional viscosity on the accuracy of the sensitivities will be discussed.

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