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The adjoint Rayleigh criterion in compressible reacting flow instabilities[1] LUCA MAGRI, MATTHEW P. JUNIPER, University of Cambridge, JONAS P. MOECK, Norwegian University of Science and Technology — Thermoacoustic oscillations are one of the most challenging flow instabilities faced by the gas turbine and rocket motor industry. The instability mechanism is described in the time domain by the Rayleigh criterion. In this contribution, the Rayleigh criterion is interpreted in the frequency domain by deriving functional formulae for the eigenvalue. The first variation of the Rayleigh criterion is calculated both in the time and frequency domain, both with and without Lagrange multipliers (adjoint variables). The Lagrange multipliers are physically interpreted with the system's observables, e.g., pressure, velocity, temperature. Finally, the adjoint Rayleigh criterion is proposed. The relations and criteria proposed can enable the calculation of adjoint sensitivities from measurable quantities in experiments. The methodology proposed is versatile and can be applied to other problems in flow instability that are tackled by adjoint analysis.

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