The Physics of Thermo-mechanical Phenomena in Gases DAVID
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Colorado-Boulder — The response of gases to transient, spatially resolved energy
addition is quantified mathematically. Non-dimensional describing equations and ac-
companying parameters are derived and used to characterize the thermo-mechanical
physics. The modeling demonstrates that the ratio of the energy addition time scale
to the acoustic time scale of the affected volume, and the quantity of energy added
to that volume during the former determine the characteristics of the response.
Conditions appropriate to classical thermo-acoustics are identified as well as those
associated with nearly isobaric and constant volume phenomena. Solutions are pre-
sented to describe the consequences of a high activation energy spatially resolved
thermal explosion occurring in a reactive gas.

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