COMBUSTION STABILITY EVALUATION OF ARTIFICIAL DISTURBANCE DYNAMIC RESPONSE

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ABSTRACT

General guidelines are provided in CPIA Publication 655[1] for evaluation of the response due to an artificial disturbance, however the guideline also allows for ambiguous interpretation. Stability rating devices that produce an artificial disturbance are traditionally explosive bombs and pulse guns. This paper reviews a recently developed objective process that can be applied consistently in the reduction of artificial disturbance dynamic data. It also examines three methods of response evaluation. The first method examines the response of a specific mode of interest and requires data filtering encompassing that mode. The second method examines the response of a specific mode of interest and its nonlinear components and requires a more complex filtering scheme. The third method examines the response of the entire dynamic system and consists of examining a wide bandwidth consisting of multiple modes of interest. The evaluation process is described and the advantages and disadvantages of the evaluation methods are discussed. Signal processing is used as a tool in quantifying the assessment, clearly as an improvement from the subjective heritage approach consisting primarily of engineering judgement. Data for several engines and components have been compiled and evaluated using these methods. A summary of these combustion devices is provided and observations are discussed.

1. "Guidelines for Combustion Stability Specifications and Verification Procedures for Liquid Propellant Rocket Engines." CPIA Publication 655, Columbia, MD, 1997.