



DETERMINING ONSET OF COMBUSTION INSTABILITY IN A COMBUSTION SYSTEM

IITM Technology Available for Licensing

Problem Statement

Combustion instability poses a negative impact on the combustors performance and structural durability of both land-based and aircraft gas turbines. Hence, there is a **need for early detection of combustion instabilities** not only for performance monitoring and fault diagnosis, but also for initiating efficient decision and control in combustion dynamics.

Technology Category/ Market

- Electronics & Circuits
- Sensors

Applications - Telecommunication, Aerospace, Transportation, Construction & Infrastructure, Oil & Gas, Power and Mining

Market - Fiber Optic Sensor Market is 7.2 B\$ expected to record a CAGR of 11.5% by 2030.

Technology

- The technology provides a robust mechanism for detecting the onset of combustion instability in a combustion system. It uses a set of fiber optic sensors, namely fiber optic bundles and Fiber Bragg Gratings (FBG, Fig.1) to simultaneously **sense chemiluminescence, pressure and temperature** respectively, which are a measure of heat release and acoustics of the combustors.
- Further, the dynamic data is analyzed over a fast symbolic time-series built upon a generalized D-Markov machine which derives the cross entropy, which is then used to **indicate the onset of combustion instability**.
- A decline in the entropy rate is experienced when there is a transition to instability. Therefore, as soon as a decay in entropy rate is noted, the impending instability can be predicted and appropriate control measures can be initiated in the combustion system.

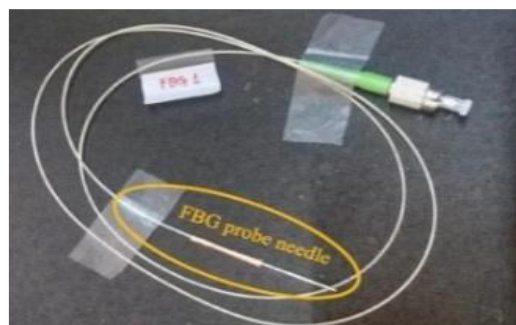


Fig.1 FBG pressure/temperature sensor probe

Intellectual Property

- IN202041015927
- PCT/IN2021/050303
- IITM IDF Ref. 1977

Value Proposition

- Fiber optical sensors offer advantages like immunity to **electromagnetic interference (EMI)**, which makes it much more attractive for field deployment compared to other conventional sensors.
- Fiber optic bundle consists of multiple multimode optical fibers with an excellent numerical aperture up to **0.6**, which provides wider viewing range.
- **Longer Stability** - the usage of an **annealed FBG** has been demonstrated to provide consistent performance over 300°C to 700°C, and may be extended to 1000°C.

TRL (Technology Readiness Level)

TRL- 4, Experimentally demonstrated using **heterogeneous sensors** for predicting the onset of combustion instability in a laboratory scale combustor

Research Lab

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