Anti-Noise Synthetic Jet Enhanced Heat Sinks

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Objective

Optimize synthetic jet operation:

(i) Maximize cooling efficiency

$$\eta = hA\Delta T / P_{el}$$

(ii) Maximum acoustic attenuation

$$\alpha = hA\Delta T / P_{ac}$$

Impact

Synthetic jets provide increased granularity in available tools for heat rejection to ambient air:

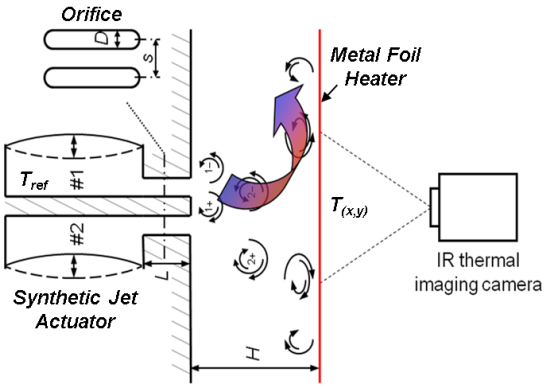
- Augment natural convection at low power consumption
- Local enhancement of forced convection for hot spot cooling
- Operation in confined geometries
- Opportunity for dynamic control via flow vectoring

Selected Publications

- T Persoons, *AIAA Journal*, 50 (4): 916-92, 2012.
- T Persoons, A McGuinn, DB Murray, *Int J Heat Mass Transfer,* 54 (17-18): 3900-3908, 2011.
- P Valiorgue, T Persoons, A McGuinn, DB Murray, *Exp Therm Fluid Sci* , 33 (4): 597-603, 2009.
- T Persoons, TS O'Donovan, *Phys Fluids,* 19 (12): 128104, 2007.

Approach

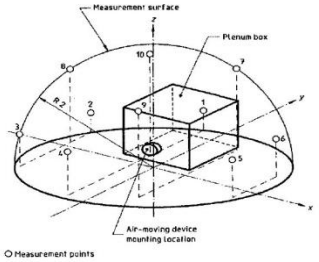
Thermal Characterization



Dual jet configuration:

- Phase-controlled fluid motion
- Acoustic noise cancellation

Acoustic Characterization

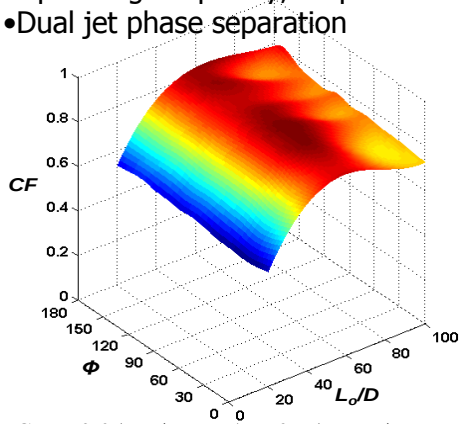


ISO 10302

Selected Results

Parametric co-optimization as a function of operating parameters

- Operating frequency, amplitude
- Dual jet phase separation



$$CF = 0.3(\eta_{T,o}/\eta_{T,o,max}) + 0.7(\eta_{A,o,dB}/\eta_{A,o,dB,max})$$

Distributions of local surface temperature and heat transfer coefficient