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Puffs in the self-similar region of a low Reynolds number round jet: a new instability DEBOPAM DAS[1], Professor, NEELAKASH BISWAS[2], Student, SANDEEP SAHA[3], Assistant Professor, AVIRAL SHARMA[4], Student
— Jets are ubiquitous in nature and are encountered in wide range of engineering application. We study the laminar to turbulence transition in the self-similar region of low Reynolds number (Re<1000) round jets emanating from a long pipe nozzle through experiments and Linear Stability Theory (LST). For the first time, we observe puffs in the far-field, self-similar region of the jet through flow visualization which is further corroborated through particle image velocimetry measurements. We delineate three regimes: In Regime I (0<Re<400) the jet remains stable, in Regime II (400<Re<700) the flow is transitional and exhibits puffs and the helical instability and in Regime III (Re>700) the flow rapidly transitions to turbulence near the nozzle exit. The helical mode is dominant in the fully developed region and prevails throughout Regime II. In contrast, puffs are less frequent and only observed in 400<Re<550. We further show that the formation of puffs is set by a superposition of helical mode pair (n = 1), predicted to be equally unstable in the fully developed region through LST.

[1]Department of Aerospace Engineering, I I T Kanpur, India
[2]Department of Aerospace Engineering, I I T Kharagpur, India
[3]Department of Aerospace Engineering, I I T Kharagpur, India
[4]Department of Aerospace Engineering, I I T Kanpur, India

Debopam Das
Professor

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