Measurement of the dispersion relation of a convectively unstable capillary jet under confinement

Por: Horvath, C (Horvath, Camila)[1]; Arratia, C (Arratia, Cristobal)[2]; Cordero, ML (Luisa Cordero, Maria)[2]

PHYSICS OF FLUIDS
Volumen: 27
Número: 11
Número de artículo: 114103
DOI: 10.1063/1.4935699
Fecha de publicación: NOV 2015
Ver información de revista

Resumen

The dispersion relation of a confined capillary jet with negligible inertia is measured by Fourier analysis of the jet radius. The real part of the dispersion relation, obtained through the spatiotemporal Fourier spectrum, demonstrates that the phase velocity is independent of the perturbation frequency, at least in the accessible range of frequencies. The imaginary part of the dispersion relation, i.e., the spatial growth rate, is frequency dependent. To measure this dependence, an external forcing is used to amplify modes with different frequencies. The spatial growth rate is then obtained from the exponential growth of the corresponding Fourier mode. The phase velocity and the spatial growth rate are found to increase and decrease, respectively, with the capillary number and to depend only weakly on the degree of confinement. These observations are consistent with a spatial instability that convects the perturbations downstream with velocity proportional to the capillary number. The frequency of the dominant mode in the absence of forcing, on the contrary, depends mainly on the degree of confinement, i.e., on the jet diameter, and only weakly on the capillary number, which is consistent with the mode selection of the Rayleigh-Plateau instability. Experimental measurements are compared to predicted dispersion relations reported in the literature, and good qualitative agreement is observed. (C) 2015 AIP Publishing LLC.

Palabras clave

KeyWords Plus:INSTABILITY; STABILITY

Información del autor

Dirección para petición de copias: Horvath, C (autor para petición de copias)

+ Univ Chile, FCFM, Dept Fis, Av Blanco Encalada 2008, Santiago, Chile.

Direcciones:

+ [1] Univ Santiago Chile, Dept Fis, Santiago, Chile

+ [2] Univ Chile, FCFM, Dept Fis, Santiago, Chile

Financiación

Entidad financiadora	Número de concesión
CONICYT Chile	Anillo ACT 127 Fondecyt Iniciacion 11100204
CONICYT/PAI, Apoyo al retorno desde el extranjero	821320055

Ver texto de financiación

Editorial

AMER INST PHYSICS, 1305 WALT WHITMAN RD, STE 300, MELVILLE, NY 11747-4501 USA

Categorías / Clasificación

Áreas de investigación: Mechanics; Physics

Categorías de Web of Science: Mechanics; Physics, Fluids & Plasmas

Información del documento

Tipo de documento: Article

Idioma: English

Número de acceso: WOS:000365687400022

ISSN: 1070-6631

eISSN: 1089-7666

Información de la revista

- **Impact Factor:** Journal Citation Reports®

Otra información

Número IDS: CX4RG

Referencias citadas en la Colección principal de Web of Science: 27

Veces citado en la Colección principal de Web of Science: 0