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Semi-automated setup for the manufacture of dual probe heat pulse (DPHP) soil moisture-sensor

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Abstract

In the dual-probe heat pulse (DPHP) sensor we have developed, avoltage pulse is applied to the heat probe across a powder-coated ultra-thinnichrome wire that is wound on a thin copper rod encased in a steel tube. Therise in temperature measured by an adjacent thermocouple probe is used toestimate the volumetric soil moisture content because heat capacity of the soilis largely influenced by the moisture in the soil. The focus of this paper is onsemi-automated manufacture of the DPHP sensor. In the current method ofprototyping of the sensor, manual winding of the powder-coated nichromewire in a double helix around the copper rod is tedious and the nichrome wireis prone to breakage or loss of insulating powder-coat. Furthermore, solderingof the nichrome wire along with the connecting wires on the solder pad is timeconsuming. The semi-automated double-helical winder mechanism developedin this work, makes use of two stepper motors while the solder-setup is pedal-controlled and has the soldering iron attached with two motorized solder wirefeeders.

Computational analysis on the three-dimensionality of turbulent duct-flow subsequent to in-plane double bends

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Abstract

We present a computational study of Prandtl's secondary flow of the firstkind in the presence of turbulence within a 90˚ in-plane double bend fitted betweentwo straight ducts. Most of the previous papers available in the literaturedemonstrate the gross flow behaviors due to out-of-plane double bends. We,however, focus on capturing the local flow behaviors in an in-plane double bend andthe progressive development of the flow downstream of the bend. We capture a pairof Dean vortices located downstream of the double bend. We trace the motion ofhigher velocity fluid particles within the vortices by in-plane velocity vectorsdirected from the pipe-core towards the bend's outer side due to an unbalancedcentrifugal force of the skewed flow. Our solutions nicely capture the decay of thein-plane flow (or secondary flow) and concurrent re-establishment of primary flowdownstream of the bend. For engineering analyses, we introduce a new parametercalled enhancement ratio (), a measure of the increase of the fluid velocity whilepassing through the bend. decreases with increasing both Reynolds numbers () andcurvature ratio (). It is realised that the reduction of is related to the corresponding fall in non-dimensional pressure loss.

Effects of Flow Noise in Characterization of Acoustic Liners at High Mean Flow

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Abstract

Bias flow acoustic liners are used to suppress thermoacoustic instabilityin jet engines. This paper aims to identify the problems associated with the flownoise and the inability of acoustic loads to characterize acoustic liners in thepresence of high mean flow. At high mean flow, conventional loads deviate fromthe criteria of being an effective acoustic load, as flow noise dominates the soundsource. Three different loads, an open-end termination, an expansion chamber,and a quasi-anechoic chamber, have been used in the present work. The acousticparameters absorption coefficient and reflection coefficient are presented toquantify the ability of acoustic loads considered at different mean flow rates. Theresults suggest the need to design an acoustic load that could absorb flow noiseand enables in-duct characterization of acoustic elements in the presence of highmean flow. At the same time, loads must not obstruct the path of flow.