THE EFFECT OF COMBUSTION-CHAMBER CONDITIONS ON FUEL SPRAYING

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In fuel injected combustion chambers, liquid fuel is injected into the combustion chamber to maintain a combustible mixture. Generally, homogeneously small fuel droplets are desirable. This is usually achieved through multiple liquid breaking mechanisms: Primary breakup of liquid jet, Secondary breakup of travelling liquid droplets, and Secondary breakup of wall-impinging liquid droplets. Indeed, many studies are devoted to the modelling of those phenomena. However, the absolute majority of these studies seem to neglect the highly non-isothermal conditions, under which spraying occurs, when a relatively cold liquid fuel is injected into a hot combustion chamber. This non-isothermal nature of that process seems to have an important effect, as it predominantly affects the most relevant to spray-breakup regions, i.e. the breaking interfacial surfaces.

It is shown that as these surfaces can be in instant contact with a combusting ambient, fuel breakup can be greatly altered by the extent of this sudden thermal exposure, through its transient effect on the physical properties of the breaking interfaces. This is shown to be of significant effect on all breakup mechanisms: primary and secondary. New models are being developed, which combine transient heat-transfer with inter-phase hydrodynamic breakup, through physical properties' dependency on temperature. These are considered in terms of effect on resultant sprayed fuel and consequent combustion quality.