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Future Energy System

Fuel Flow Modelling

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The cavitating liquid fuel flow in the diesel injector nozzle has been studied computationally using the zero wall shear model. The zero wall shear model will be validated experimentally in a rig.

When combustion in the cylinder is computed, the exit flow velocity from the nozzle is one boundary condition. It is important that this boundary condition is as near as possible the real velocity. The cavitation in the nozzle increases when the Nurick's cavitation number decreases.

Slug flow model

Commonly, the fuel velocity at the outlet of the nozzle is computed with the slug flow model. The exit flow area from the nozzle is equal to the geometric cross sectional area A_g. The fuel outlet velocity u_g is calculated using the area A_g.

Zero wall shear model

The exit flow area A_2 of the zero wall shear is smaller than the geometric cross sectional area A_g of the nozzle, Figure 1. Thus the outlet velocity is higher with the zero wall shear model than with the slug flow model.

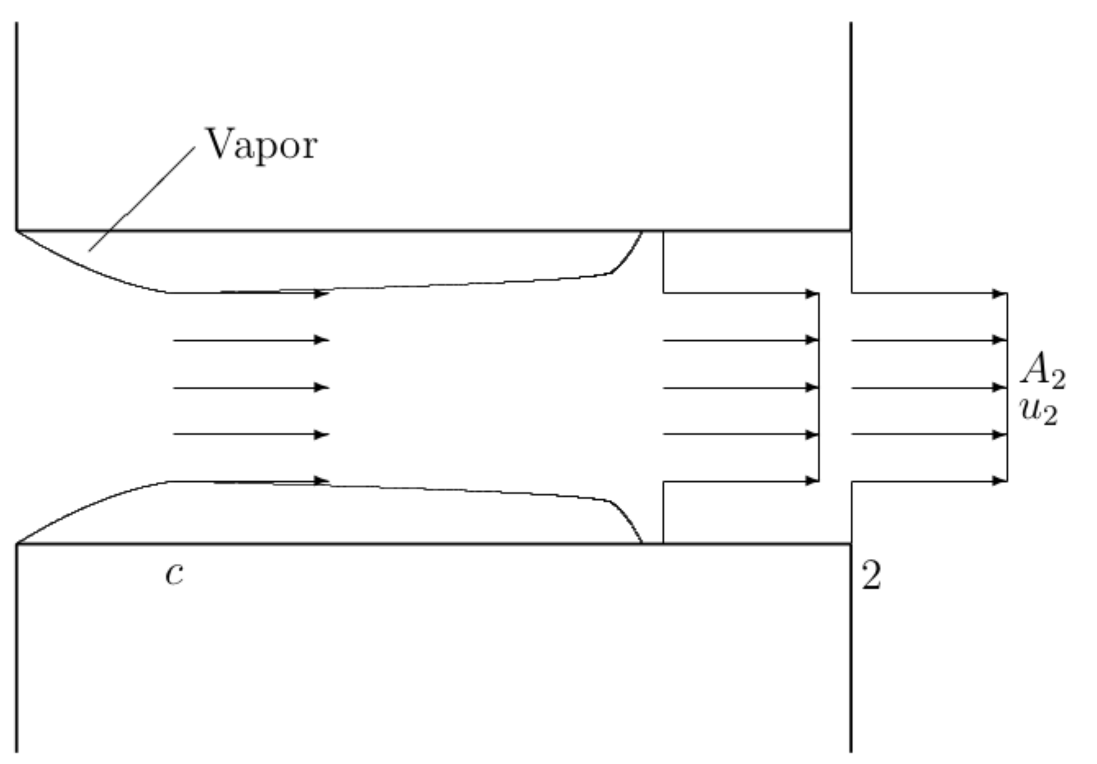

Figure 1. Schematic of the zero wall shear model.

In the literature, the zero wall shear model has been shown to be more accurate than the slug flow model.

Computed results

The flow areas were computed for two nozzles. The nozzle sr is an old one and not used any more in injection systems. The nozzle r is a modern nozzle.

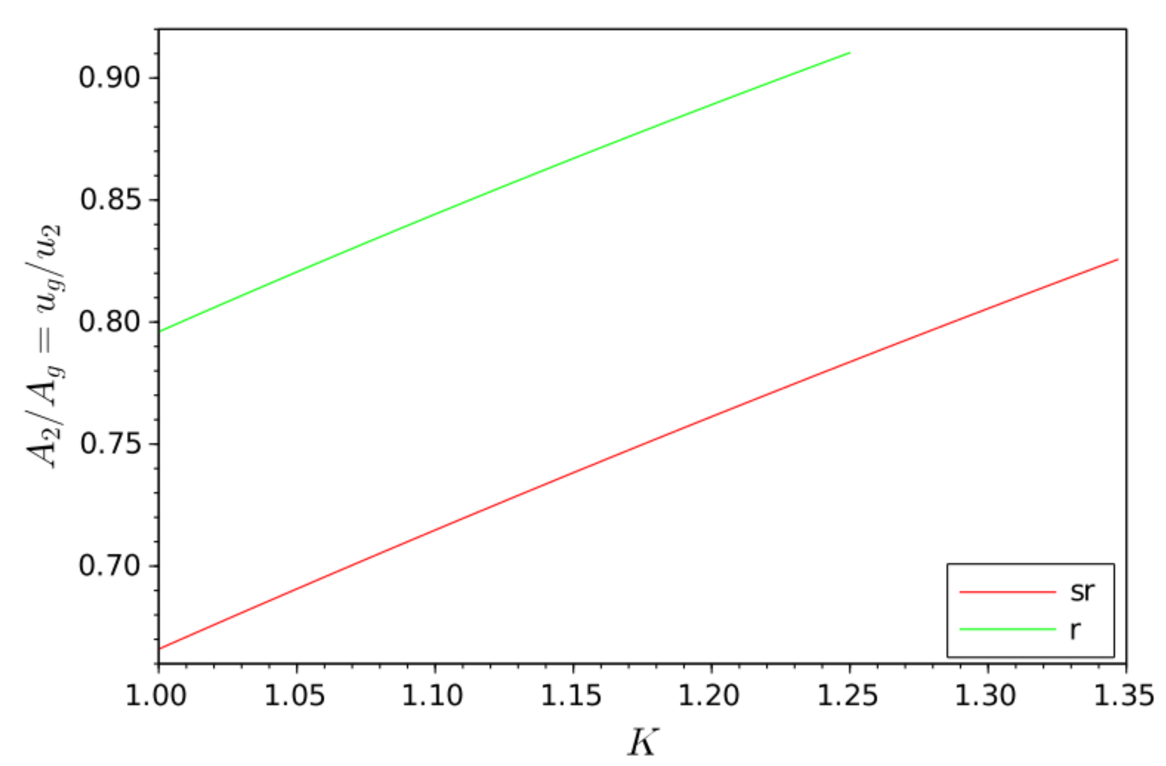

Figure 2. The computed area ratios for the nozzles.

In Figure 2, the outlet flow area ratio of the fuel nozzle is seen as a function of the Nurick's cavitation number K.

According to the computed area ratios for the nozzles, the exit flow area A_2 is notably smaller than the geometric cross sectional area A_g.

The area ratio is smaller for the modern nozzle compared to the old one.