



Design and Analysis of Rocket Nozzle

P CHINMAI

M. Tech Student, Department of MECH, Malla Reddy college of Engineering and Technology, Hyderabad, India.

K BICHA

Assistant Professor, Department of MECH, Malla Reddy college of Engineering and Technology, Hyderabad, India.

Dr. P H V SESA TALPA SAI

Professor, Department of MECH, Malla Reddy college of Engineering and Technology, Hyderabad, India.

Abstract : The nozzle is utilized to change over the compound warm vitality created in the ignition chamber into motor vitality. The spout changes over the low speed, high weight, high temperature gas in the ignition chamber into high speed gas of lower weight and temperature. Spout is a gadget intended to control the rate of stream, speed, heading, mass, shape, as well as the weight of the stream that fumes from them. Spouts arrive in an assortment of shapes and sizes relying upon the mission of the rocket, this is critical for the comprehension of the execution attributes of rocket. Joined dissimilar spout is the most normally utilized spout since in utilizing it the force can be warmed in burning chamber. In this theory examination is done to the focalized dissimilar spout by changing distinctive spout measurements and diverse liquids at various speeds. We displayed focalized dissimilar spout changing with various spout distances across and Analyzed the joined disparate spout with various mass stream rates to decide the weight drop, warm exchange coefficient, and speed and warmth exchange rate for the liquid by CFD strategy.

I. INTRODUCTION

The essential difficulties towards growing new diesel motors for voyager autos be the strict future emanation enactment together with the client's requests for relentless rising execution. For example, the emanation impediments of Tier a couple of Bin five needs a convoluted once treatment framework and a strong ignition strategy that limits discharges inside the technique for them being molded.

II. IMPORTANCE OF NOZZLE

Advancements inside the innovation of Diesel Injection (DI) frameworks have fight in important part inside the improvements that are made up to the present reason. Consolidating the lessening in spout section widths through expanded stream attributes with swelled infusion weights gives an opportunity to create motors that incorporates high power thickness and diminished emanations. The main drawback to those stylish shower opening geometries is that they normally endure a markdown of intensity yield all through long run task. Elective investigations have known these vital developments of stores in light of the fact that the principle explanation behind this conduct.

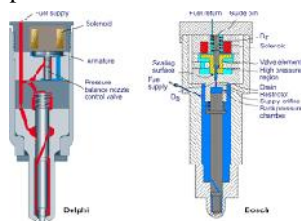


Figure 1 Delphi and bosch nozzle and it's parts

III. OBJECTIVES OF THE PROJECT

The essential objectives of this investigation were to look into the key reasons for the development of stores inside the splash opening and to find out the main parameters that advance the arrangement and thusly the rot of stores. The consequent advance was to search out measures that will chop down or possibly repress the arrangement of those stores. It completely was resolved to partition the examination into 2 sub-ventures. The essential sub-venture took care of the test examinations, and also a nearby store investigation. The focus of the contrary sub-venture was on reenacting the consequences of grouped spout sorts (round and hollow, ks-spout) on warm exchange and liquid stream, using coupled CFD-and warm displaying. Furthermore, investigation was directed on the warm situation of the spout, including an affectability examination concerning the warm conditions at the gismo tip. Cavitation and warm impacts were furthermore encased as a region of the examination. This record features the exploratory outcomes, and in addition the store investigation. The consequences of the contrary sub-venture region unit part printed

IV. LITERATURE REVIEW

Design and Optimization of Fuel Injection System in Rocket Using Biodiesel – A Review H. M. Pate

Fuel infusion is frameworks for providing high pressurize fuel to most extreme blending of fuel with air in an inner burning motor. Coordinate Injection (DI) Systems as utilized as a part of DI

motors, in which the fuel is infused straightforwardly into an ignition chamber shaped in the barrel itself. The fuel injector straightforwardly infuses fuel into the immediate fuel infusion framework. The injector is an exceptionally convoluted part, and huge research has been done to enhance it. In my work showing the advancement of fuel injector framework to decrease chocking issue which is for the most part occur in bio diesel motor. The infusion spouts and their individual spout holders are crucially essential segments arranged between the in-line infusion pump and the diesel motor, its capacities are as metering the infusion of fuel, administration of the fuel, characterizing the rate-of-release bend, Sealing-off against the burning, chamber. Mechanical write injectors utilized as a part of direct infusion framework. At the point when biodiesel is utilized as a part of the rocket stifling issue is made in fuel injector. In this way, we improve the outline of fuel injector segment, and attempted to keep the chocking issue. The diesel fuel injector framework straightforwardly infuses fuel into the framework without chocking.

INTRODUCTION TO CAD

PC supported outline (CAD) is that the utilization of pc frameworks (or workstations) to help inside the creation, alteration, examination, or change of a style. Computer aided design bundle is utilized to expand the efficiency of the fashioner, enhance the standard of style, enhance correspondences through documentation, and to shape a data for delivering. Computer aided design yield is more often than not inside the kind of electronic documents for print, machining, or elective delivering tasks. The term CADD (for pc helped style and Drafting) is moreover utilized.

INTRODUCTION TO CREO

PTC CREO, erst called Pro/ENGINEER, is 3D demonstrating bundle used in building science, outline, creating, and in CAD drafting administration organizations. It had been one among the essential 3D CAD demonstrating applications that utilized a control based steady amount framework. Exploitation parameters, measurements and choices to catch the conduct of the stock, it will upgrade the occasion item furthermore in light of the fact that the style itself.

CREO constant quantity modules:

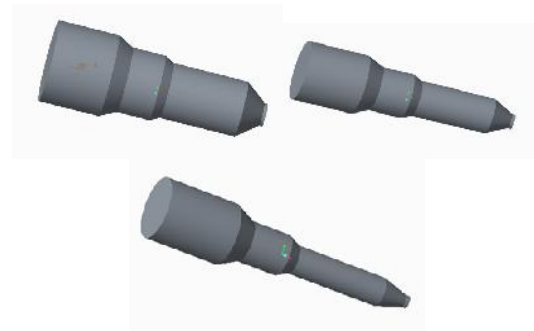
- Sketcher
- Part modeling
- Assembly
- Drafting

INTRODUCTION TO FEA

Finite part examination might be a strategy of finding, in some cases generally, beyond any doubt issues in building and science. It is utilized fundamentally for issues that no exact determination, express capable in some scientific kind, is available. In that capacity, it's a numerical rather than Associate in nursing explanatory strategy.

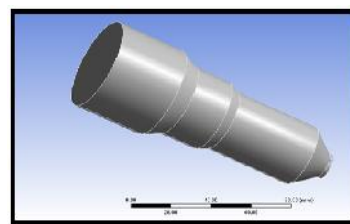
V. MODELIG AND ANALYSIS

3D MODEL OF DIESEL NOZZLE

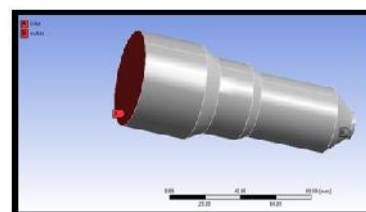
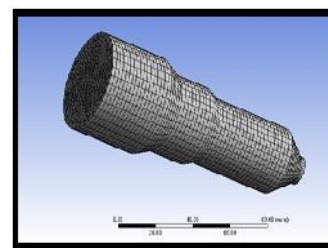


nozzle models with 50, 40, 30mm diameter

Velocity inlet = 200m/s, 300m/s & 400m/s

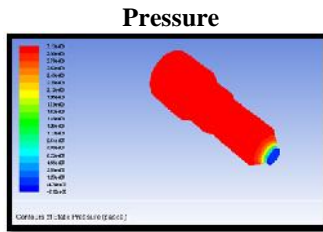


MESHED MODEL BOUNDARY CONDITIONS



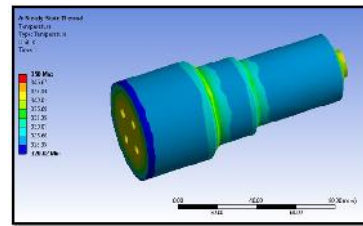
Nozzle with 50mm diameter:

VELOCITY INLET= 200m/s

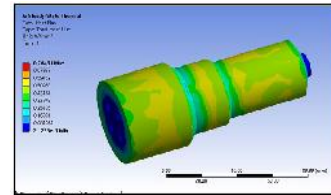


Pressure

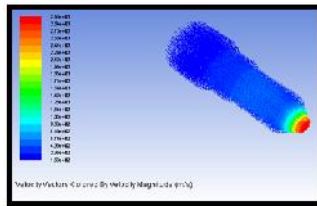
Temperature



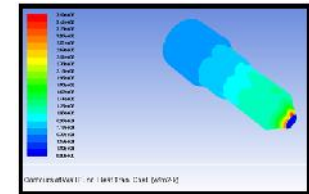
Heat flux



velocity



mass flow rate & heat transfer rate



Mass Flow Rate (kg/s)	
inlet	285.04136
interior-MSDR	17727.3244
outlet	-285.18033
wall-MSDR	0
Net	-1.1389465
Total Heat Transfer Rate (W)	
inlet	2889320.3
outlet	-2900060.8
wall-MSDR	0
Net	-11540.5

VI. RESULTS

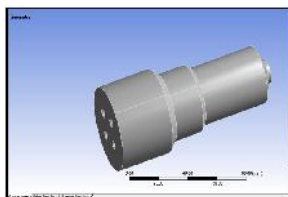
TABLE 8

RESULTS FOR INLET VELOCITY ANALYSIS

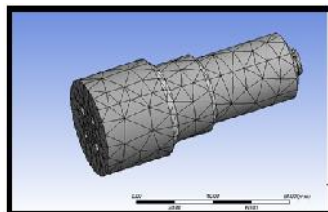
Nozzle dia.	Inlet velocity (m/s)	Pressure (Pa)	Velocity (m/s)	Heat transfer coefficient (W/m ² -K)	Mass flow rate (kg/s)	Heat transfer (W)
50	200	3.12e+09	2.98e+03	3.59e+05	1.138945	11540.5
	300	6.96e+09	4.46e+03	5.10e+05	0.289245	2927.5
	400	1.25e+10	5.99e+03	6.56e+06	3.087343	31294
40	200	4.53e+09	3.58e+03	3.76e+05	1.0157764	10600
	300	1.03e+10	5.38e+03	5.30e+05	2.192199	22219
	400	1.83e+10	7.17e+03	6.80e+05	2.9817107	30249
30	200	1.04e+10	5.36e+03	6.90e+05	0.16120148	1634.3125
	300	2.34e+10	8.05e+03	8.05e+03	0.44642	4520.625
	400	4.18e+10	1.07e+04	1.25e+06	0.8333587	8450.75

THERMAL ANALYSIS OF NOZZLE

Material –brass
 Imported model



Meshed model



Thermal analysis result table

Material	Temperature (K)		Heat flux(W/mm ²)
	Min	Max	
Brass	320.02	350	0.76451
Aluminum	323.59	350	0.87036

VII. CONCLUSION AND FUTURE SCOPE

Nozzles arrive in an assortment of shapes and sizes relying upon the mission of the rocket, this is essential for the comprehension of the execution qualities of rocket. Concurrent disparate spout is the most normally utilized spout since in utilizing it the charge can be warmed in ignition chamber. In this postulation the concurrent dissimilar spout changing the diverse spout widths and distinctive liquids at various speeds. We displayed focalized disparate spout changing with various spout widths. By watching the CFD examination of

rocket spout the weight, speed, warm exchange rate and mass stream rate esteems are increments by expanding the delta speeds and diminishing the spout dia. By watching the warm investigation, warm transition is more for aluminum compound contrasted and metal material. So it can be finished up the rocket spout productivity were progressively when the spout dia. diminishes.

VIII. BIBLIOGRAPGHY

- [1] J.B. Heywood, "Internal Combustion Engine Fundamentals", McGraw-Hill Book Co, pp 493-494, 1988.
- [2] D. Ing. H. Tschöke, "Diesel distributor fuel-injection pumps", Robert Bosch GmbH, pp 12-53, 1999.
- [3] B. Challen R. Baranescu, "RocketReference Book" Reed Educational and Professional Publishing Ltd., Second Edition, pp.260-301, 1999.
- [4] M. Volmajer, B. Kegl, "Experimental and numerical analysis of fuel flow in the rocketinjection nozzle" , Journal of Kones. Combustion Engines, Vol. 8, No. 1-2, 2001.