Pulsed Compression on single stage compressors

Theoretical study of high energy compression (power compressor)

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Abstract

This Study is doing on the basics of the probability to develop a compressor which perform this process under the sophisticated design of the casing of the compressor. In many reason, space agencies and aviation experts are looking for this models such as using hyper sonic jet planes, safest satellite longing and Military operations. Next generation space travel might happen on the basics of the speed of the craft and its cost of production. Every year, airline companies and Airplane manufactures are spending huge amount of money for holding their Gas turbine version of jet production.

Gas turbine and its limitations, decrease the possibilities of traveling at the hyper-sonic speed. In such a time, pulsed compression offers high speed travel and fuel efficient jet production.

More clearly saying, jet propulsion can define as the method of producing Newton's third low in perpetually. So any device which capable to produce Newton's third low with high efficiency can propel our space vehicles. In this contest, pulsed compression for hyper-sonic speed is relevant.

Key words:

high energy molecule, M-B distribution, Bessel function, molecular space, matric tensor, adiabatic compression and Power compressor

List of simple

k Boltzmann constant

T Temperature

m mass flow

A_1 coefficient of Bessel's formula

$j_n x$ Bessel's function

v_{rms} root mean square velocity of moving air Colum

w^iwork along the direction of air flow

w_i component of work along I

$x^{i`}$ displacement of air on compressor

$g_{ii`}$ matric tensor of the p v space

P v space is the combination of P-space, having 3 coordinates and V-space, having 3-coordinate

Q is the increased heat energy

S is the entropy

Introduction

The ongoing activities of Hyper sonic airplanes are struggling to make a perpetual flow of jet, without having any moving pats and this decline the production of operational Hyper-sonic engines. More than 20 tests were conducted by different groups on it, but that was really done by the cupping of 2 different engines such as Turbo jet and Rockets, but they never uses any technological advantages for replace the uses of two engines. In such a scenario, high energy compression has signifies.

In my model of Compressors, the high energy air molecules where trapped inside the compressor casing and this propel to the Combusting Chamber by adding Breath air on it. This breath air can obtain from APU and Liquid Oxygen Tanks.

Way of operation

In every stage, we provide high energy molecules to the Compressor casing and this can be happened on it by uniform increase of velocity of the trapped air. According to the M-B distribution, Molecules get accelerated under the increase of ambient Temperature. Where velocity

(RMS) can be define as the square root of the ambient temperature. This means that for high temperature, the velocity increase.

$$v_{rms} = \sqrt{\frac{3kT}{m}} \quad 1$$

Considering the increase of temperature, it should be a uniform, because, the action of a compressor will be adiabatic. So there will be no adding or subtraction of heat energy happened. This means that the system should be closed. But the molecule should travel to the casing for compression. So sophisticated duct design is relevant.

Again, the transfer of temperature to the closed casing can be obtain as a solution of Bessel function of gamma of negative quantity as zero and that is

$$T = A_1 j_n x \quad 2$$

From this expression it can conclude that the progress of temperature along the compressor is like a series solution. So the velocity is also progress as the square root of this temperature.

$$v_{rms} = \sqrt{\frac{3k(A_1 j_n x)}{m}} \quad 3$$

However, we have a challenge over hear, that is, we have right to increase the temperature of the compressor, at the same time it should be under thermal insulation. So adding heat energy is impossible for it. In such a scenario we think about the application of high energy bread air.

$$Q = S * T \quad 4$$

For fine entropy (S) and Temperature (T), the heat energy should be finite and, if we increase the temperature of the bread air, it races the heat energy and Entropy as well. This high energy air molecule then transfer to the compressor casing. So the ambient conditions of compressor get highs.

By progressive observation of T, Q, we can monitor the entropy. When it reaches the threshold(maximum), we gradually supply's the bread air with increase of temperature, heat energy and entropy which equal to the ambient conditions of the compressor casing.

When the brad air with high energy molecule, combine with the molecules having the same condition in the casing, the curvature of the molecules on the compressor alien on the direction of flow. This will increase by increase of its pressure. When pressure increase, the work don by the compressor happens, without having any rotating part.

$$w^i = \frac{1}{2} w_i x^{i`} \frac{\partial(\log(g_{ii`}))}{\partial x^{i`}} \quad 5$$

Where $g_{ii`}$ is the matric tensor of the combination of p-space and V-space along the direction of flow. Where i on the superscript indicate the work on the molecular space and subscript is the component of that work along the direction of motion along molecular space.

This is happening on the secondary compressor or power compressor and the real scramjet compressor is primary compressor which can access air from the surrounding.

In the case of power compressor, the direct access of air is comparatively low, and we transform the bread air on the power compressor. Briefly define, the 99.9999 percentage of air at power compressor should be manipulated in to high energy format. However, there is some chance to access air on the atmosphere to the power compressor. So highly efficient design is very impotent for power compressor manufacturing.

Result

Power compressor can give power to the compressor of a scramjet engine and this will trigger the hyper-sonic propulsion of the aircraft

Reference

Books

[1] S. Lokanathan and R.S Gambhir, *Statistical and Thermal physics*, PHI Learning Private Limited Delhi-110 092, 2016

[2] J. c. Upadhyaya, *Classical mechanics*, Himalaya Publication House, Mumbai- 40004, July 12, 2005

[3] Satya Prakash, *Mathematical Physics with classical mechanic*, Sultan Chand & Sons, New Delhi-110 002, first Edition 1985-86, Fifth and enlarged edition 2006, Reprint 2014, Reprint 2015,

[4] Mathur D.S & M.N. Bapat, *Heat and Thermodynamics*, Sultan Chand & Sons, New Delhi 110 002. 2005

Online Resources

[1]. https://www.nasa.gov/missions/research/f_scramjets.html

[2]. https://www.isro.gov.in/launchers/isros-scramjet-engine-technology-demonstrator-successfully-flight-tested

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I Christine Cherian completed my post-graduation course in physics (Electronic) in the year 2017. My college was St. Benchman's and I took my graduation from the very same Institution in the field Physics. My college is working under the potential of Mahatma Gandhi University Kottayam Kerala and which was accredited by UGC. I completed my 10 and 12 levels form state syllabus

Now I am looking for doing a PhD in applied Physics on Tensor format and it will be an honor to me if I got an opportunity to publish my work on your prestige's journal

Thankyou for giving you valuable time for me