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(Title Page)

Heat Transfer Characteristics of Flow Between Two Parallel Plates

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by

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(Md. Ruhul Amin)

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in (Name of Department)

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Khulna 920300, Bangladesh

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Nomenclature *(Font size 12, Bold, Times New Roman and Left Indent)*

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C_p	Co-efficient of Pressure, $\frac{(P - P_a)}{2 \rho v_j^2}$
d	Jet diameter in m.
k	Thermal conductivity of fluid (air). (W/m. -K)
Nu	Average Nusselt number.
Re	Reynolds number based on the diameter of the jet.
X	Non dimensional length along the jet.
x	Length along the jet, in m.
ε	Dimensionless relative roughness.

CHAPTER I

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Introduction

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1.1 General *(Font size 12, Bold, Times New Roman, two blank spaces after article no, and Left Indent)*

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Electronics cooling has served as a key enabling technology in the development of advanced microelectronic systems. With the increase in heat dissipation from microelectronics devices and the reduction in overall form factors, electronics cooling becomes a more and more important element of electronic product design.

Thermal management of electronic equipment has become an important issue because of increased power levels and the simultaneous miniaturization of the devices. With the advent of denser device packaging and faster intrinsic speeds, cost, reliability and size have been improved, but, unfortunately, thermal management have not followed at the same speed. As a result, it may be difficult to use the latest technology available.

1.2 Flow Phenomena *(Font size 12, Bold, Times New Roman, two blank spaces after article no, and Left Indent)*

The surface roughness encountered in practice varies in their shape, size, distribution and arrangement, micro-scopical surface property, characteristics behavior with flow etc. The roughness formed by sand particles or stone chips is called sand roughness. Nikurades described the sand roughness from technical point of view. The average absolute protrusion height of the roughness elements or the relative roughness heights with respect to some significant length are used to describe such roughness.

1.2.1 Types of Flow *(Font size 12, Bold, Times New Roman, two blank spaces after article no, and Left Indent)*

1. **Axial Flow:** Depending on the ratio of the height of the roughness ribs and pitch, such roughness can be divided into D-type and K-type roughness. When the error in the origin is proportional to the height of the roughness elements then the roughness is called K-type or sand grain roughness.

2. **Radial Flow:** For a D-type roughness the error in origin is a linear function of the distance in the downstream direction. For specific engineering purposes the roughness elements for different geometrical shape are sometimes used, their characteristic length defines these. Another type of roughness termed as tuft roughness are also sometimes encountered. The examples of these types of roughness are grassy lands, green bushes, cornfields, and green mosses grown in the ship hull.

Table 3.1: The value of different variables published by other investigator's are shown

Sl. No.	Velocity m/Sec	Temperature ^{o}C	Altitude m	Pressure Kg/cm^2
1				
2				
3				
4				

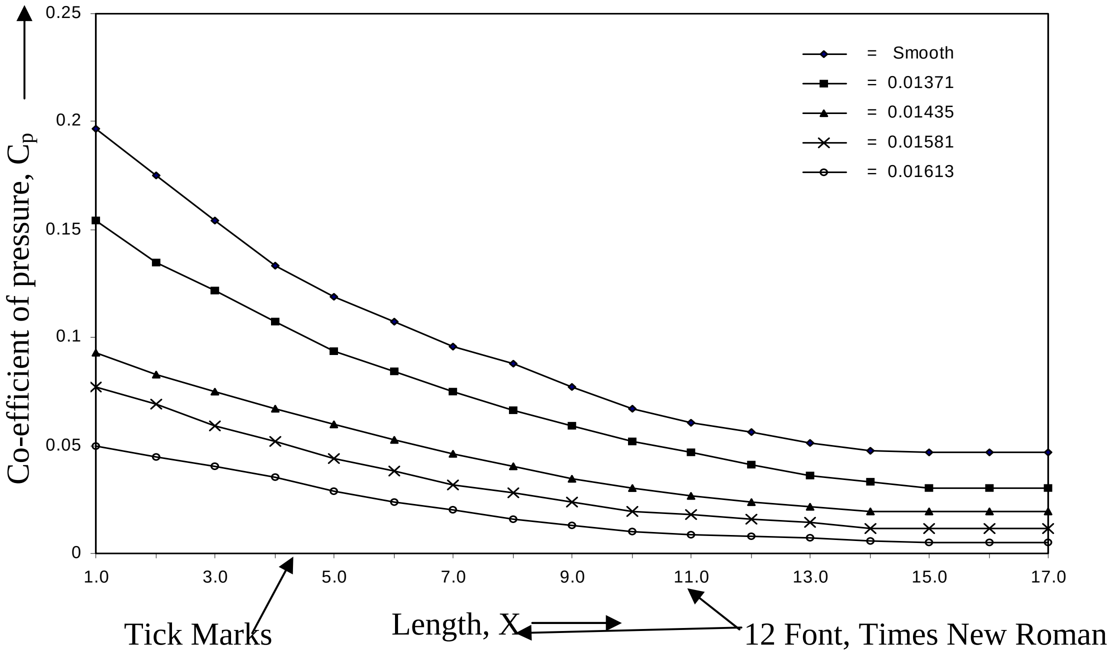

Figure 4.1: Distribution co-efficient of pressure along axial locations varies with surface roughness at a particular flow situation.

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