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Design and Fabrication of Automated Air Conveyor

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Abstract: ***An automated air conveyor system was developed for transporting objects. The air conveyor forms a thin film underneath the object for support and simultaneously generates a controlled airflow that results in viscous traction. It is potentially applicable in the manufacturing process for semiconductor wafer or flat foodstuffs, where mechanical contact is expected to be avoided during transportation of the products to minimize contamination. The air conveyor employs duplicated arrays of actuating cells that are square pockets with a surrounding dam. A simple model is proposed to characterize the viscous force.***

The theoretical analysis reveals that the total force is the composition of an actuating force generated in the pocket areas and the side areas and a drag force generated in the dam areas.

Experimental investigations are conducted on the basic characteristics of the film pressure distribution and the viscous force. The results show that the air film pressure is symmetrically distributed in the width direction but non symmetrically distributed in the length direction.

The viscous force increases if the suction flow rate is enlarged or the gap thickness is narrowed.. Amplitude of the actuating force is adjusted using a control valve to vary the suction flow rate. The simulated and the experimental results verify the feasibility of the air conveyor system and the control method.

Keywords: Automated, Light weight, pressure distribution, transportation, Viscous force.

I. INTRODUCTION

The basic aim of this project is to move the object in Non-contact mode to avoid mechanical contact forces. Air pump can be fixed on the conveyor without belt to move the object under air flow.

The Noncontact vacuum grippers can be used. The vacuum grippers generate an upward lifting force and thereby can pick-and-place a planar object. We have to develop a smart automated conveyor where goods can move at very high speeds without ever coming in contact with the conveyor.

The upper layer of conveyor can be made up of a glossy sheet that consists of drilled holes at accurate distance from one another. The lower section of the sheet can be a hollow space that acts as a compressed air tank. The air pressure from the tank is gradually released through small holes drilled on the top conveyor surface.

The conventional air-cushion method forms an air Film to support the object but cannot provide a horizontal actuating force because the supplied airflow is perpendicular to the surface.

The more the hole size the powerful the pump must be as per calculations. Need to design a standard hole size and appropriate pump to move small goods/product boxes.

II. LIST OF COMPONENTS

1) Compact Fan
2) Acrylic Sheet
3) SMPS
4) Side support rods/ rails
5) Conveyor Legs
6) Base Frame
7) Supporting Frame
8) Screws and Joints

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III. FABRICATION

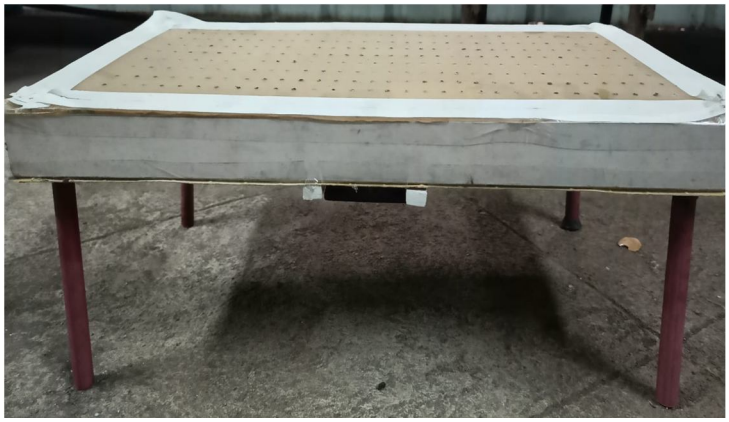


Figure1. Automated Air Conveyor

A smart automated conveyor is the one where goods can move at very high speeds without ever coming in contact with the conveyor. This conveyor system makes use of air pressure to achieve this task.

The upper layer of conveyor is made up of a glossy sheet that consists of drilled holes at accurate distance from one another. The lower section of the sheet is a hollow space that acts as a compressed air tank. The air pressure from the tank is gradually released through small holes drilled on the top conveyor surface.

The hole size and distance is calculated as per the size and weight of objects to be moved on the conveyor. The larger and heavier the object to be moved the larger the hole size and larger the distance between holes. Now as per the hole size and distancing, we hereby select appropriate air pumps to pump compressed air into the air tank. The more the hole size the powerful the pump must be as per calculations. Well we here use a hole size and appropriate pump to move small goods/product boxes.

The conveyor has 4 legs attached to it that are mounted in a way to provide a slope for gravity based movement. In case slope cannot be provided, separate air pressure/pneumatic piston can also be used to set the goods in motion. The conveyor has 2 side rails to prevent goods from falling from the conveyor. Once the object is set in motion it hovers over the conveyor in travels seamlessly in pushed direction without friction. Thus this system provides a modern automated goods transport system that has no contact, lower maintenance and very less moving parts for easy goods movement.

IV. BENEFITS

1) They provide flexibility.
2) They are agile in the operations.
3) They maintain a constant flow.
4) They instantly become ergonomic.
5) Low cost
6) They let the products to accumulate, which helps to have a brief storage and a growth of the systems' productivity.
7) They manage irregular and regular products.
8) They let feed the lines where there is not available room on the floor.
9) They save space.

V. RESULT AND DISCUSSION

Air conveyors are better suited when handling corrosive or high temperature gas because they do not use electricity, can be supplied in appropriate materials, are lightweight and compact for easy installation, and virtually maintenance free.

In this study, a completely automated air conveyor system is developed to transport .A simplified model derived from the film flow behaviour is proposed to correlate the viscous force with the suction flow rate and the gap thickness. Experimental setups were established to measure the film pressure distribution and the viscous force, and the basic characteristics were studied. The film pressure is symmetrically distributed in the width direction but non symmetrically distributed in the length direction. This means that only the viscous force along the airflow direction in the pockets needs consideration. Moreover, the total viscous force is the composition of an actuating force generated in the pocket areas and the side areas and a drag force generated in the dam area.

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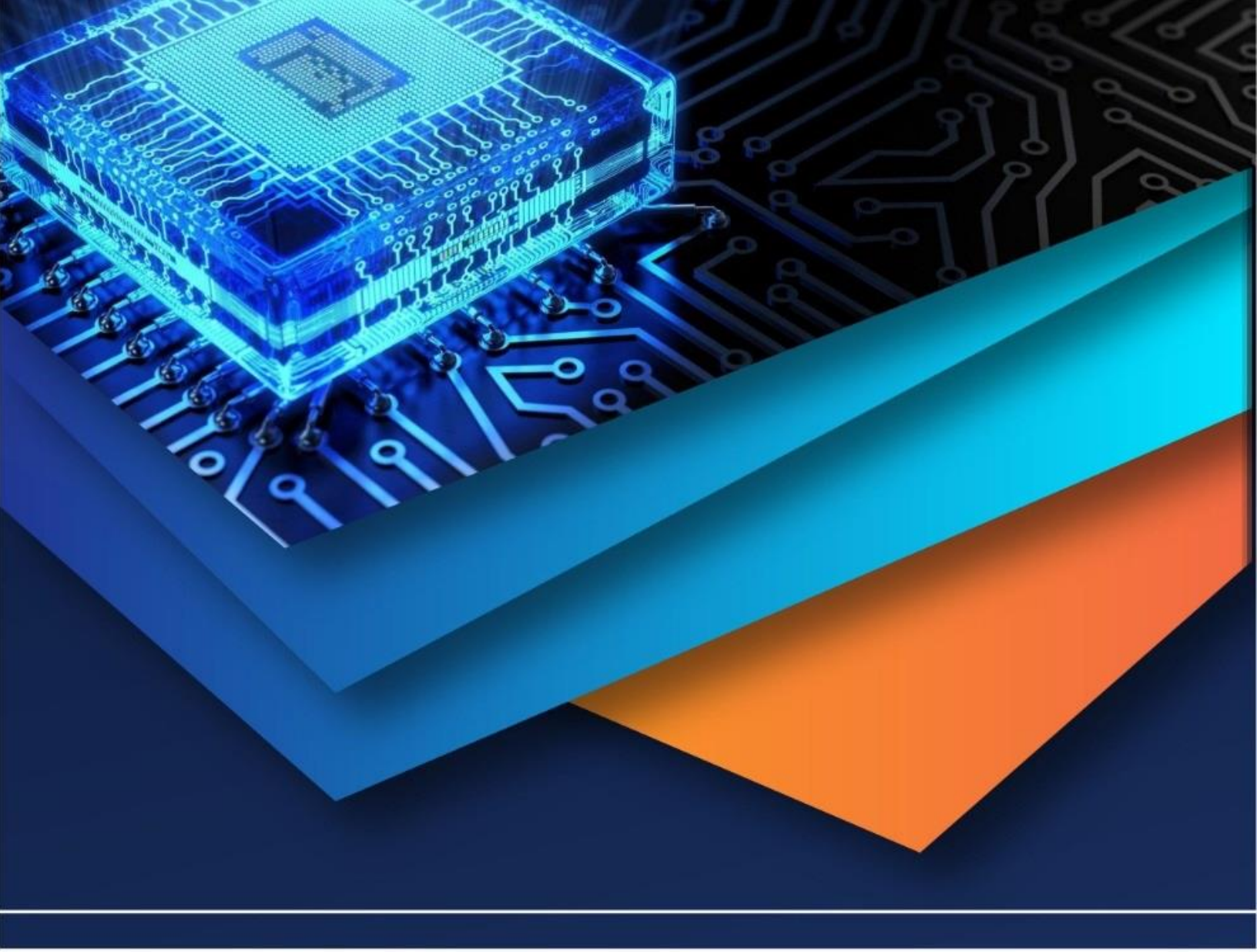
The viscous force increases if the suction flow rate is enlarged or the gap thickness is narrowed. Actually, the viscous force exhibits a more significant variation than expected as did the change of the suction flow rate, which would indirectly influence the floating height of the object and thus reinforce the effects. Comparison of the experimental results and the simulated results indicates that the model can accurately predict the viscous force, which is necessary for the motion simulation. These basic characteristics are of great importance for performance evaluation in industrial applications.

VI. FUTURE SCOPE

1) By Increasing the RPM of the fan we can be able to move heavy objects in the automated air conveyor.
2) The noise produced by the compact fan can be reduced.
3) The SMPS can be removed if the DC fan is changed to an AC fan.

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